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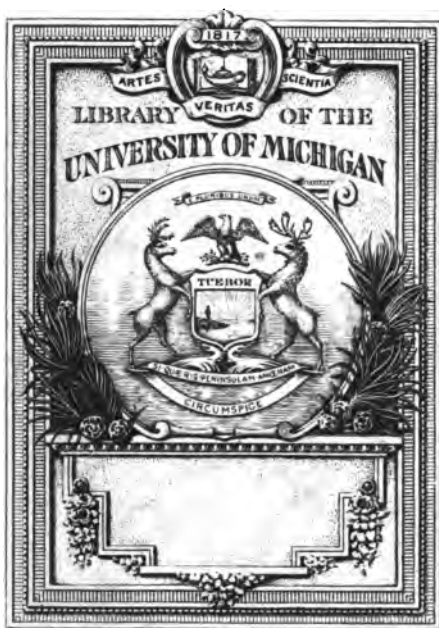
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THE
American Tutor's Assistant

IMPROVED:

OR, A COMPENDIOUS SYSTEM OF DECIMAL,
PRACTICAL

ARITHMETIC;

COMPRISING THE USUAL METHODS OF CALCULATION,

WITH THE ADDITION OF

FEDERAL MONEY, AND OTHER DECIMALS,

Dispersed through the several rules of that useful science.

ADAPTED FOR THE EASY AND REGULAR INSTRUCTION OF YOUTH
IN THE UNITED STATES.

COMPILED BY ZACHARIAH JESS.

CONTAINING ALSO,

**A COURSE OF BOOK KEEPING,
BY SINGLE ENTRY.**

STEREOTYPED BY D. & G. BRUCE, NEW-YORK.

Baltimore:

PUBLISHED BY CUSHING & JEWETT,
NO. 6, NORTH HOWARD STREET.

.....
1827.....

DISTRICT OF PENNSYLVANIA, to wit :

Be it Remembered, That on the third day of June, in the forty-second year of the Independence of the United States of America, A. D. 1818, M^cCarty & Davis of the said district have deposited in this office the title of a book, the right whereof they claim as proprietors, in the words following, to wit :

L. S.

“The American Tutor's Assistant, improved : or a Compendious System of Decimals, Practical Arithmetic ; comprising the usual methods of calculation ; with the addition of Federal Money, and other Decimals, dispersed through the several rules of that useful science. Adapted for the easy and regular instruction of Youth in the United States. Compiled by Zachariah Jess. Containing also, a Course of Book Keeping, by Single Entry.”

In conformity to the act of the Congress of the United States, entitled, “An act for the encouragement of learning, by securing the copies of maps, charts and books, to the authors and proprietors of such copies, during the times therein mentioned.” And also to the act, entitled, “An Act supplementary to an act, entitled, ‘An Act for the encouragement of learning, by securing the copies of maps, charts, and books to the authors and proprietors of such copies, during the times therein mentioned,’ and extending the benefits thereof to the arts of designing, engraving, and etching historical and other prints.”

D. CALDWELL,
Clerk of the District of Pennsylvania

Hist. & Science

London: 1843

2-10-43

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PREFACE.

The utility of a work of this kind, accommodated to the Federal Money of the United States, is too obvious to need any comment.

The position of Decimals, in former systems of Arithmetic, seem to have shut them out from general use.—The necessity and advantage of that mode of calculation, for Federal Money, must be conspicuous to every person who has an acquaintance with figures; and therefore my early introduction of that rule, will, I hope, be approved.

The present state of commerce in the United States, renders a knowledge of calculations in pounds, shillings, &c. necessary. I have, therefore, endeavoured to combine the old form with the new, in such a manner, as to furnish the pupil with a competent knowledge of both methods of calculation.

I have stated copious examples with explanatory notes in the three earlier cases of Compound Multiplication, and reversed those examples in Compound Division, for the purpose of giving the scholar frequent exercise in fixing the decimal point, on which the accuracy of decimal calculations entirely depends:—and in these examples, I have not adhered to the particular rules of the several cases.

In Reduction, I have given a sufficient number of examples for changing the old denominations of money, from one to another. I have then introduced the three cases of Decimal Reduction, with various examples relative to the foregoing. Then follow weights and measures in the common method, succeeded by decimal examples under each head, and notes of reference to the rules in the preceding cases.

The Rule of Three being the foundation of Arithmetical knowledge, I have furnished the pupil with various examples, both in the common and decimal methods under that head.

The several cases in Practice, are not essentially useful in the calculations of Federal Money, except the last; but I have given several examples, that the scholar may not be altogether ignorant of calculations by that rule.

Under the head of Interest, I have introduced the decimal rule immediately after the common; the contrast will clearly show the superiority of the Decimal mode.

I have also given a new rule, in Notes, for concisely finding the interest of any number of Dollars for any time.

Z. JESS.

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EXPLANATION OF CHARACTERS.

<i>Signs.</i>	<i>Significations.</i>
=	equal; as 20s.=£. 1.
+	more; as 6+2=8.
—	less; as 8—2=6.
×	into, with, or multiplied by; as, 6×2=12.
÷	by, (i. e.) divided by; as, 6÷2=3: or 2)6(3.
: ::	proportionality; as, 2 : 4 :: 6 : 12.
√ or $\sqrt[3]{}$	Square Root; as, $\sqrt{64}=8$.
$\sqrt[3]{}$	Cube Root; as, $\sqrt[3]{64}=4$.
$\sqrt[4]{}$	Fourth Root; as, $\sqrt[4]{64}=2$.
—	A Vinculum; denoting the several quantities over which it is drawn, to be considered jointly as a simple quantity.

ARITHMETIC.

ARITHMETIC is the art of computing by numbers. It has five principal rules for its operation, viz. Numeration, Addition, Subtraction, Multiplication, and Division.

NUMERATION.

NUMERATION teaches to express numbers by figures, set down or named, and consists of two parts, viz.

First, The right placing of them.

Second, The true valuing of each figure in its proper place ; both of which are exhibited in the following table.

Units	1	One
Tens	2 1	Twenty-one
Hundreds	3 2 1	Three Hundred and twenty-one
Thousands	4 3 2 1	4 Thousand 321
Tens of Thousands	5 4 3 2 1	54 Thousand 321
Hundreds of Thousands	6 5 4 3 2 1	654 Thousand 321
Millions	7 6 5 4 3 2 1	7 Million 654 Thousand 321
Tens of Millions	8 7 6 5 4 3 2 1	87 Million 654 Thousand 321
Hundreds of Millions	9 8 7 6 5 4 3 2 1	987 Million 654 Thousand 321

The above Table is comprised in the following :

Units	3 2 1	Units.
Tens		
Hundreds		
Thousands	6 5 4	Thousands.
Tens of Thousands		
Hundreds of Thousands		
Millions	9 8 7	Millions.
Tens of Millions		
Hundreds of Millions		

Addition of Integers.

Nine figures are sufficient to express any number in common practice; nevertheless the following table may be thought necessary.

<i>Nonmillions</i>	<i>Octillions</i>	<i>Septillions</i>	<i>Sextillions</i>	<i>Quintillions</i>
857324,	162486,	345986,	437916,	423147,
<i>Quadrillions</i>	<i>Trillions</i>	<i>Billions</i>	<i>Millions</i>	<i>Units</i>
248016,	234521,	161734,	386149,	623137

EXAMPLES.

In figures express the following numbers :

One hundred and six.

Five hundred and thirty-eight.

Six thousand and seventy-four.

Twelve thousand, five hundred and ten.

Forty-five thousand, six hundred and one.

Two hundred fifty-one thousand, six hundred.

Eight million, one hundred forty-two thousand, and six.

Sixty-five million, one hundred four thousand, and ninety

Five hundred and two million, three hundred and four thousand.

Nine hundred forty-eight million, six hundred thirty-two thousand, seven hundred and fifty-one.

Numbers are also expressed by letters, and are called *Numeral Letters*, or *Roman Numbers*, thus :

1	2	3	4	5	6	7	8	9	10	20	30
I,	II,	III,	IV,	V,	VI,	VII,	VIII,	IX,	X,	XX,	XXX,
40	50	60	70	80	90	100	500	1000			
XL,	L,	LX,	LXX,	LXXX,	XC,	C,	D,	M,			

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MDCCCXX.

A letter of less value, standing before one of greater, diminishes, but when placed after, increases the value of the greater. Hence by combining the above letters, other numbers are formed.

ADDITION OF INTEGERS.

ADDITION of integers is the collecting of several numbers, of like signification, into one sum; as 6 and 8 make 14.

RULE.

Place units under units, tens under tens, &c. then begin at the right hand column and add upwards, set down the total, if less than 10, if 10 or more, the right hand figure, and add the left to the next row of figures, which is carrying 1 for every 10; and so proceed to the last column, and there set down the whole of said column.

PROOF.

Perform the addition downward ; Or, add the top line to the sum of all the rest ; and if right, the total will be equal to the first.

EXAMPLES.

271684	756087	47165178
728316	243913	52134822
643868	656486	67856321
356132	343514	32143679
786418	789676	64576814
648679	689677	24576816
<hr/>		
Tot. 3435097		
<hr/>		
4567891	2345675	8153456
5432109	7654325	1846544
3675284	1826557	1863725
6324716	8163443	8136275
8273561	4658376	1628571*
1726439	5341624	5371429
6382596	7554876	9758594
6382590	7554879	9654597
<hr/>		
<hr/>		

Application.

Note. In this, and some succeeding collections, the pupil may be directed to write the question on his slate, with vacancies, in which the tutor may insert other numbers.

1. Add 5856, 3840, 395, 263, 25, and three thousand, seven hundred, and eighty-four together. *Facit* 14165.

2. A man was born in the year 1698, in what year will he be 99 years of age ? *Ans.* in 1797.

3. If a person have owing to him on bond 807 dol. in book accounts 1047 dol. in bills and notes 86 dol. and have in cash 487 dol. how much is the amount ? *Ans.* 2427 dol.

4. Admit a bond to be 4687 dol. interest due thereon 178 dol. what is the amount ? *Ans.* 4865 dol.

5. Suppose 5784 guineas in one purse, 588 in another, 84 in a third, and seven hundred and seventy-nine in a fourth, what number is there in them all ? *Ans.* 7235.

6. Admit a boy had 357 nuts given to him at one time, 127 at another, 78 at another, 378 at another, 57 at another ; how many had he in all ? *Ans.* 997

7. Suppose a person dying left his widow 3840 dol. his eldest son 6850 dol. to two other sons each 2584 dol. to each of his three daughters 1685 dol. and in other legacies 950 dol. what is the sum of these bequests? *Ans.* 21863 dol.

8. A draper bought 10 bales of cloth, viz. No. 1, 2, each 367 yards; No. 3, 4, 5, each 407 yards; No. 6, 7, 8, each 228 yards; No. 9, 10, each 300 yards; how many yards in the whole purchase? *Ans.* 3239 yards.

9. A grocer bought 8 casks of Indigo, viz. No. 1, 210 lb. No. 2, 196 lb. No. 3, 4, 5, each 205 lb. No. 6, 184 lb. No. 7, 125 lb. No. 8, 1274 lb. how many pounds in all? *Ans.* 2604 lb.

10. A merchant bought 7 bales of cloth, in 4 of which were 52 pieces, which contained 1352 yards, the other 3 had 40 pieces, and contained 1098 yards; how many pieces and yards were there? *Ans.* 92 pieces, 2450 yds.

SUBTRACTION OF INTEGERS.

SUBTRACTION of Integers is the taking of a less number, called the subtrahend, from a greater, of the same signification, termed the minuend, and shews the remainder or difference.

RULE.

Put the less number under the greater, with units under units, tens under tens, &c. then begin at the right hand, and take the lower figure from that above it; but if it be greater than that above, take it from ten, and add the upper figure to that remainder, set down the result, and carry one to the next place; and so proceed.

PROOF.

Add the remainder to the less number, and the sum must equal the greater—

Or, subtract the remainder from the greater number, and the difference will be equal to the less.

EXAMPLES.

From	4736985	9736214	18346152	74614328
Take	1514863	4878946	9804675	70840679
Rem.	3222122	4857268		
Proof.	4736985	9736214		

From	473648217	648271681	81621261	680081681
Take	97808604	48918692	198718	9903718
Rem.	<u> </u>	<u> </u>	<u> </u>	<u> </u>

Application.

1. Borrowed 1090*l.* and paid 909*l.* how much remains?

Ans. 181*l.*

2. A man was born in the year 1698, what is his age this present year 1817?

Ans. 119.

3. If from 101010 be taken 10101, and from the remainder, 9099, what number will be left?

Ans. 81810.

4. A boy who had one thousand nuts, sold 286, gave away sixty, and lost 437; how many had he left?

Ans. 217.

5. There were four purses of money, containing 1*st*, 34*l.* 2*nd*, 50*l.* 3*d*, 100*l.* 4*th*, 150*l.* which were to be paid into the treasury; but one of them being lost, only 234*l.* were paid; which was the purse lost?

Ans. 100*l.* purse.

6. Having a piece of ground 172 feet long, and rent to A at one end 57 feet, and to B 42 feet at the other end; how much was left between them?

Ans. 73 feet.

7. Suppose A had owing to him on bond 478*l.* and interest due thereon 98*l.* and received at two payments each 199*l.* how much is unpaid?

Ans. 178*l.*

8. A vintner bought 20 pipes of brandy, containing 2459 gallons, and sold 14 pipes containing 1682 gallons; how many pipes and gallons were left?

Ans. 6 pipes, 777 gallons.

9. If the amount of a bond be 4700 dol. and part payments 1478 dol. 1319 dol. 826 dol. and 628 dol. how much remains unpaid?

Ans. 449 dol.

10. In four purses were different coins to the amount of 1000 dol. in the first 109 dol. in the second 280 dol. in the third 217 dol. what was in the fourth?

Ans. 394 dol.

MULTIPLICATION OF INTEGERS.

MULTIPLICATION of Integers is the rule for finding a number equal to any other, taken any proposed number of times.

In which there are three parts, viz.

First, The *Multiplicand*, or number to be multiplied,

Second, The *Multiplier*, or number to multiply by,

Third, The *Product*, or number produced, which is equal to the multiplicand taken as often as there are units in the multiplier.

Note. The multiplier and multiplicand are also called *factors*, and the product is sometimes termed *fact*, or *rectangle*.

TABLE.

1	2	3	4	5	6	7	8	9	10	11	12
2	4	6	8	10	12	14	16	18	20	22	24
3	6	9	12	15	18	21	24	27	30	33	36
4	8	12	16	20	24	28	32	36	40	44	48
5	10	15	20	25	30	35	40	45	50	55	60
6	12	18	24	30	36	42	48	54	60	66	72
7	14	21	28	35	42	49	56	63	70	77	84
8	16	24	32	40	48	56	64	72	80	88	96
9	18	27	36	45	54	63	72	81	90	99	108
10	20	30	40	50	60	70	80	90	100	110	120
11	22	33	44	55	66	77	88	99	110	121	132
12	24	36	48	60	72	84	96	108	120	132	144

CASE 1.

When the multiplier does not exceed 12;

RULE.

Place the multiplier under the multiplicand; multiply the several figures successively from right to left, carry the tens, and set down the overplus as in Addition.

PROOF.

Repeat the operations with the factors changed; Or, multiply the double of one factor by half the other. Or, the product of the multiplicand by double the multiplier, will equal the former product multiplied by 2.

EXAMPLES.

Multiplicand	4513627	51473639	75134628	64132579
Multiplier	2	3	4	5
Product	9027254			
83174261	4137282	75136982	80736013	
6	7	8	9	

Multiplication of Integers.

11

9761486	87140651	273406152	90748362
10	11	12	12
<hr/>	<hr/>	<hr/>	<hr/>
<hr/>	<hr/>	<hr/>	<hr/>

CASE 2.

When the multiplier consists of several figures.

RULE.

Make as many products as there are figures in the multiplier, omitting cyphers, and place the first figure of each product exactly under its multiplier; add the products together, and their sum will be the number sought.

Note. If cyphers be in one or both factors at the right hand, annex them to the product.

EXAMPLES.

1. Mul. 7643827 by	23	Facit 175808021
2. 8142630 by	75	610697250
3. 9436170 by	920	8681276400
4. 3760410 by	4840	18200384400
5. 815036000 by	70300	57297030800000
6. 1900460 by	161500	306924290000
7. 3800920 by	80750	306924290000
8. 6247386495 by	27356	170903504957220
9. 12494772990 by	13678	170903504957220
10. 47001881 by	1140090	53586374509290
11. 94008762 by	570045	53586374509290
12. 233926899 by	13679508	3200004886285692

Application.

1. Suppose 40 men were concerned in the payment of a debt, and each man paid 2564l. how much was the debt?

Ans. 102560l.

2. How many square feet are in a floor 46 feet in length, and 35 in breadth?

Ans. 1610.

3. If 9876 be multiplied by six thousand, seven hundred and eighty-nine, what is the product?

Ans. 67048164.

4. Bought 342 bales of linen, in each bale 56 pieces, and in each piece 25 yards; how many pieces and yards were therein?

Ans. 19152 pieces, 478800 yds.

5. A merchant bought 7 bales of cloth, in each bale 11 pieces, and in each piece 29 yards; how many pieces and yards were there? *Ans.* 77 pieces, 2233 yards.

6. Sold 8 bales of linen; in four of which were 9 pieces each, and in each piece 27 yards; in the other 4 were 12 pieces each, and in each piece 31 yards; how many pieces and yards were there? *Ans.* 84 pieces, 2460 yards.

7. A linen-draper bought 10 bales of cloth, viz. No. 1, 2, each 367 yards; No. 3, 4, 5, each 407 yards; No. 6, 7, 8, each 228 yards; No. 9, 10, each 300 yards; how many yards in all? *Ans.* 3239.

8. What is the product of 13578 multiplied by 4988? *Ans.* 67048164.

9. Admit an orchard consisting of 126 trees one way, 109 the other, 1007 apples on each tree; how many trees and apples are in said orchard? *Ans.* 13734 trees, 13830138 apples.

10. A certain island contains 52 counties, each county 42 parishes, each parish 246 houses, and each house 10 persons; how many parishes, houses and persons are in the island? *Ans.* 2184 parishes, 537264 houses, 5372640 persons

DIVISION OF INTEGERS.

DIVISION of Integers is the reverse of Multiplication, and shews how often one number is contained in another. It consists of four parts, viz.

First, The *Dividend*, or number to be divided.

Second, The *Divisor*, or number to divide by.

Third, The *Quotient*, or number sought.

Fourth, The *Remainder*, (if any) which must be less than the divisor, and of the same name with the dividend.

Simple Division is of two kinds, viz. short and long.

SHORT DIVISION.

Short Division is that in which the divisor does not exceed twelve.

RULE

Seek how often the divisor is contained in the first figure or figures of the dividend, under which set the result; if any remain, conceive it to be prefixed to the next figure, seek how often the divisor is contained therein, and so proceed.

Division of Integers.

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PROOF.

Multiply the quotient by the divisor, adding in the remainder, if any, and the product will be the dividend.

EXAMPLES.

Dividend		
Divisor 2)7346286	3)5112896	4)37612285
Quotient 3673143	1704298 2	
2	3	
Proof 7346286	5112896	
5)97036120	6)74830956	7)91430682
8)37846210	9)76004181	10)47490172
11)41036294	12)64381259	12)59436128

LONG DIVISION.

Long Division is that wherein the divisor exceeds 12.

RULE.

Take for the first dividial, as many only of the first figures of the dividend as will contain the divisor; try how often the divisor may be had therein, and set the resulting figure for the first of the quotient, subtract the product of this figure into the divisor from the dividial, and the remainder with the next figure of the dividend annexed, will be the second dividial, with which proceed as before, &c. till the dividend figures are exhausted.

PROOF.

As in Short Division—Or thus, the dividend, less the remainder, divided by the quotient, will quote the divisor. Or, the dividend, less the remainder, doubled, and divided by twice the divisor, will give the same quotient.

Division of Integers.

EXAMPLES.

Dividend

$$\begin{array}{r}
 \text{Divisor } 41 \overline{) 94979} \quad (2316 \text{ Quotient} \\
 \underline{82} \qquad \qquad \qquad \underline{41} \\
 129 \qquad \qquad \qquad 2319 \\
 \underline{123} \qquad \qquad \underline{9266} \\
 67 \qquad \qquad \qquad 94979 \text{ Proof} \\
 \underline{41} \\
 269 \\
 \underline{246} \\
 \text{Remainder } 23
 \end{array}$$

			Quotient.	Rem.
2. Divide	7461389 by	95	Fac.78540	89
3.	5374608 by	671	8009	569
4.	9736205 by	2507	3883	1524
5.	756390289 by	41659	18156	29485
6.	9871369542 by	87648	112625	13542
7.	19742712000 by	175296	112625	
8. }	139736422224 by	476838	293048	
9. }		293048	476838	
10. }		586096	476838	
11. }		476838	586096	
12.	2011527857382426 by	47821682	42063093	

Note. If one or more cyphers be on the right of the divisor, omit them in the operation, separating from the right of the dividend as many figures, which annex to the remainder.

EXAMPLES.

1. Divide 8317642500 by 814600 Facit 10210 rem. 576500
2. 16634132000 by 1629200 10210
3. 87521885000 by 12749000 6865
4. 350087540000 by 27460000 12749

Application.

1. A person intending to go a journey of 3264 miles, would perform it in 136 days; how many miles must he travel each day?

Ans. 24.

2. Several boys went to gather nuts, and collected 4273, which when shared among them, each had 855; how many boys were in company? *Ans. 5.*

3. If the expense of erecting a bridge be 50221. to be defrayed equally by 186 persons; how much must be the quota of each? *Ans. 271.*

4. The quotient of an operation in division is 1763, the dividend 3435955; query the divisor? *Ans. 4785.*

5. What number is that, which being multiplied by 7969 the product will be 1864746? *Ans. 234.*

6. Being desirous to plant 2072 apple trees in 14 rows, how many will be in each row? *Ans. 148.*

7. In 670320 yards, how many pieces and bales, allowing 35 yards in each piece, and 56 pieces in each bale?

Ans. 19152 pieces, 342 bales.

COMPOUND ADDITION.

COMPOUND ADDITION teaches to add several sums or quantities together of divers denominations, but of the same quality, as money, weights, measures, &c.

GENERAL RULE.

Place the numbers so, that those of the same denomination may stand directly under each other.

Then begin at the right hand column, and add up as in integers; divide the total by as many of that denomination as will make one of the next greater, set down the remainder (if any) under said column, and carry the quotient to the next, &c.

PROOF. As in Integers.

MONEY.

The denominations are,

4 farthings (marked <i>qr.</i>)	make	1 penny, marked <i>d.</i>
12 pence	- - -	1 shilling, <i>s.</i>
20 shillings,	- - -	1 pound, <i>l.</i>

Note. The shillings may be added as integers, carrying half the number of tens to the pounds, and prefixing the odd ten (if any) to the units under shillings.

PENCE TABLE.

d	s.	d.
20 pence make	1	8
30 - - -	2	6
40 - - -	3	4
50 - - -	4	2
60 - - -	5	0
70 - - -	5	10
80 - - -	6	8
90 - - -	7	6
100 - - -	8	4
110 - - -	9	2
120 - - -	10	0
240 - - -	20	0

TABLE OF SHILLINGS.

s.	l.	s.
20 shillings make	1	0
30 - - -	1	10
40 - - -	2	0
50 - - -	2	10
60 - - -	3	0
70 - - -	3	10
80 - - -	4	0
90 - - -	4	10
100 - - -	5	0
110 - - -	5	10
120 - - -	6	0
130 - - -	6	10

EXAMPLES.

£.	s.	d.	£.	s.	d.	£.	s.	d.
487	13	8	6785	14	9	4791	13	5
512	6	4	4214	5	3	5238	6	7
671	11	3	7489	19	11	6351	11	4
764	18	10	6051	13	6	3678	8	8

Tot. 2436 10 1

£.	s.	d.	£.	s.	d.	£.	s.	d.
8764	12	8	6785	11	8½	6715	12	8½
1235	7	4	3214	8	3½	3284	7	3½
7589	0	3	7856	14	9½	6789	13	6½
2410	19	9	2143	5	2½	3210	6	5½
8768	18	11	7890	14	6½	8764	14	11½
4682	19	4	4247	10	8½	1867	15	6

£.	s.	d.	£.	s.	d.	£.	s.	d.
374	14	7½	617	15	9½	381	17	3½
625	5	4½	382	4	2½	618	2	8½
471	13	6½	475	12	7½	463	13	7½
528	6	5½	524	7	4½	536	6	4½
715	16	8½	836	10	8½	257	11	6½
284	3	3½	163	9	3½	742	8	5½
362	12	7½	711	18	6½	376	16	8½

Application.

1. Suppose a merchant on settling his accounts finds he owes A, seventy-four pounds, seventeen shillings and six pence; B, six hundred twenty-seven pounds, six shillings; C, eight hundred forty-seven pounds, eighteen shillings and four pence; three farthings; D, 56*l.* how much does he owe in all?

<i>£.</i>	<i>s.</i>	<i>d.</i>
A,	74	17 6
B,	627	6 0
C,	847	18 4 $\frac{3}{4}$
D,	564	0 0

2. If A have owing to him on bond 190*l.* 17*s.* 10 $\frac{1}{2}$ *d.* and interest due thereon 191*l.* 2*s.* 1 $\frac{1}{2}$ *d.* how much is the amount?

Ans. 2100*l.*

3. Suppose a vintner bought 40 tuns of wine for 684*l.* loading and unloading stood him in 17*l.* 13*s.* 8 $\frac{1}{2}$ *d.* storage 8*l.* 10*s.*; custom 16*l.* 13*s.* 9 $\frac{1}{2}$ *d.* land carriage 19*l.* 14*s.* 6 $\frac{3}{4}$ *d.* how much do the cost and charges amount to?

Ans. 746*l.* 12*s.* 0 $\frac{3}{4}$ *d.*

FEDERAL MONEY.

The denominations are,

10 mills (<i>m</i>) make	1 cent, <i>c.</i>
10 cents	1 dime, <i>d.</i>
10 dimes, (100 <i>cts.</i>)	1 dollar, <i>D.</i>
10 dollars	1 Eagle, <i>E.</i>

The Standard Weight.

	<i>dwt.</i>	<i>gr.</i>	
A dime,	1	16 $\frac{2}{3}$	silver.
A dollar,	17	1 $\frac{3}{4}$	
An half eagle,	5	14 $\frac{1}{2}$	gold.
An eagle,	11	4 $\frac{3}{4}$	

Note. The Federal standard for gold and silver, is 11 parts fine, and one part alloy.

EXAMPLES.

<i>D.</i>	<i>d.</i>	<i>c.</i>	<i>m.</i>	<i>D.</i>	<i>c.</i>	<i>D.</i>	<i>d.</i>	<i>c.</i>	<i>m.</i>
74,	3	8	6	133,	47	575,	4	5	3
35,	6	1	4	860,	63	424,	5	4	7
54,	3	2	1	188,	02	394,	0	5	4
45,	6	7	9	861,	98	605,	2	4	6
34,	5	6	7	369,	09	437,	0	6	3
89,	0	1	2	754,	91	958,	0	3	7
<hr/>				<hr/>		<hr/>			
323,	5	7	9						
<hr/>				<hr/>		<hr/>			

A TABLE OF COINS which pass current in the United States of North America, with their Sterling and Federal Value.

<i>Names of Coins.</i>	<i>Standard Weight.</i>	<i>Sterling Money of Great Britain.</i>	<i>New Hampshire, Massachusetts, Rhode Island, Connecticut and Virginia.</i>	<i>New York and North Carolina.</i>	<i>New Jersey, Pennsylvania, Delaware and Maryland.</i>	<i>South Carolina and Georgia.</i>	<i>Federal Value.</i>
			<i>l. s. d.</i>	<i>l. s. d.</i>	<i>l. s. d.</i>	<i>l. s. d.</i>	<i>Doll. Cts. Mills.</i>
(GOLD.)	dot. gr.	l. s. d.	l. s. d.	l. s. d.	l. s. d.	l. s. d.	D. C. M.
A Johannes, - -	18 03 12	0 4 16	0 6 8	0 6 8	0 6 8	0 4 0	16 00 0
A Half Johannes, - -	9 01 16	0 2 8	0 3 4	0 3 4	0 3 0	0 2 0	8 00 0
A Doubloon, - -	16 21 3	0 6 0	0 8 0	0 5 16	0 5 12	0 3 10	14 93 3
A Moldore, - -	6 18 1	0 1 16	0 2 8	0 2 8	0 2 5	0 1 8	6 00 0
An English Guinea, - -	5 6 1	0 1 0	0 8 0	0 1 17	0 1 15	0 1 1	4 66 7
A French Guinea, - -	5 5 1	0 1 0	0 7 6	0 1 16	0 1 14	0 1 3	4 60 0
A Spanish Pistole, - -	4 6 0	0 6 6	0 1 2	0 1 9	0 1 8	0 0 18	3 77 3
A French Pistole, - -	4 4 0	0 6 0	0 2 0	0 1 8	0 1 7	0 0 17	3 66 7
(SILVER.)							
An English, or French Crown, - - -	19 00 5	0 6 8	0 8 9	0 8 9	0 8 3	0 5 0	1 10 0
The Dollar of Spain, - -	17 60 4	0 6 0	0 6 0	0 8 0	0 7 6	0 4 8	1 00 0
Sweden or Denmark, - -	3 18 0	0 1 0	0 1 4	0 1 9	0 1 8	0 1 0	0 22 2
An English Shilling, - -	3 11 0	0 10 3	0 1 2	0 1 7	0 1 6	0 0 11	0 20 0
A Pistaren, - -							

All other Gold Coins of equal fineness, at 89 cents *per dot.* and Silver at 111 cents *per gr.*

A TABLE of other Foreign Coins, &c. with their value in Federal Money, as established by a late Act of Congress.

	<i>D. c. m.</i>		<i>D. c. m.</i>
Pound Sterling,	4 44 0	Rupee of Bengal,	0 55 0
Pound of Ireland,	4 10 0	The Quilder of the United	
Pagoda of India,	1 84 0	Netherlands,	0 36 0
Tale of China,	1 48 0	Mark Banco of Hamburg,	0 23 0
Mill-ree of Portugal,	1 24 0	Livre Turnois of France,	0 18 0
Ruble of Russia,	0 88 0	Real Plate of Spain,	0 0 0

EXAMPLES.

<i>D.</i>	<i>c.</i>	<i>m.</i>
816,	42	5
683,	57	5
425,	61	4
574,	38	6
353,	12	2
746,	87	8
117,	41	6
458,	73	3

<i>D.</i>	<i>c.</i>	<i>m.</i>
466,	38	6
533,	61	4
825,	53	7
174,	46	3
318,	26	5
681,	73	4
456,	83	2
337,	16	3

<i>D.</i>	<i>c.</i>	<i>m.</i>
416,	35	3
583,	64	7
341,	34	8
758,	65	2
143,	53	9
156,	16	1
436,	88	4
573,	63	8

Note. In writing down any number of cents less than 10, a cypher must be prefixed in the place of dimes. The figure next to the separating point on the left hand, is dollars, and all to the left of that, eagles; but eagles and dollars may be read together as dollars; dimes and cents, as cents; likewise cents and mills, or dimes, cents, and mills, enumerated mills; thus, 323,579, may be 323 dolls. 57 cents, and 9 mills, or 323 dolls. 579 mills, &c.

Application.

1. Laid out at sundry times, viz : at one time 100 *dollars*, at another 75 *cts.* at a third 4 *dolls.* 7 *mills*, and lastly 19 *dolls.* 4 *cts.*; query the whole expenditure? *Ans.* 123 *dolls.* 79 *cts.* 7 *m.*
2. How much federal money equals 1 English guinea, 2 French crowns, and 3 Spanish pistoles? *Ans.* 18 *d.* 18 *c.* 6 *m.*
3. Admit a person left his widow the use of 6436 *dolls.*; for charitable purposes 297 *dolls.* 96 *cts.*; gave three nephews each 1546 *dolls.* 72 *cts.*; three nieces each 1324 *dolls.*; and to his executors 304 *dolls.* 12½ *cts.*; what is the sum of these several bequests? *Ans.* 15650 *dolls.* 24½ *cts.*
4. Suppose a man borrowed a sum of money, and paid in part at one time 34 *dolls.* 65 *cts.*; at another 62 *dolls.* 31 *cts.*; at a third time 122 *dolls.* 6 *cts.*; and the remainder is 101 *dolls.* 87½ *cts.* what was the sum borrowed? *Ans.* 320 *dolls.* 89½ *cts.*
5. Bought 3 horses for 73 *dolls.* 18½ *cts.* each, and two cows for 17 *dolls.* 75 *cts.* each, and three bushels of wheat for 4 *dolls.* 60 *cts.*; what is the amount? *Ans.* 259 *dolls.* 65½ *cts.*

TROY WEIGHT.

By this weight, jewels, gold, silver, and liquors are weighed.

The denominations are,

24 grains (<i>grs.</i>)	make 1 penny-weight, marked <i>dwt.</i>	
20 penny-weights	1 ounce,	<i>oz.</i>
12 ounces	1 pound,	<i>lb.</i>

Compound Addition.

EXAMPLES.

<i>lb. oz. dwt. gr.</i>	<i>lb. oz. dwt. gr.</i>	<i>lb. oz. dwt. gr.</i>
7 10 11 15	21 4 13 16	34 1 10 13
2 1 8 9	78 7 6 8	165 10 9 11
4 6 7 12	36 5 10 14	13 6 12 22
5 5 12 12	63 6 9 10	86 5 17 1
9 11 13 15	38 9 18 23	58 8 9 19
6 10 19 23	67 10 19 21	327 11 19 4

Application.

1. What is the sum of 36 pounds, 7 ounces, 16 penny-weights; 48 pounds, 7 ounces, 16 grains, and 56 lb. 6 oz.?

Ans. 141 lb. 8 oz. 16 dwt. 16 gr.

2. A goldsmith bought 7 ingots of silver, three of which weighed each 9 lb. 7 oz. 14 dwt. and each of the rest 8 lb. 5 oz. 15 dwt. 16 gr. how much did the whole weigh?

Ans. 62 lb. 10 oz. 4 dwt. 16 gr.

3. Admit a goldsmith has 4 tankards weighing each 7 oz. 18 dwt. spoons weighing 4 lb. 6 oz. 3 salvers each 6 lb. 4 oz. what is the weight of the whole?

Ans. 26 lb. 1 oz. 12 dwt.

4. Suppose a silversmith sold 14 dishes weighing 18 lb. 3 oz. 14 dwt. 36 plates weighing 48 lb. 1 oz. 15 dwt. 6 salts weighing 5 lb. 7 oz. 4 salvers 11 lb. 10 oz. 12 dwt. Required the weight of the whole

Ans. 83 lb. 11 oz. 1 dwt.

5. Bought three pair of sleeve buttons, each weighing 11 gr. 2 basins, weighing 1 lb. 5 oz. 4 dwt. 14 gr. and 2 pair of buckles, each 2 oz. 11 dwt. how much do they weigh together?

Ans. 1 lb. 10 oz. 7 dwt. 23 gr.

6. Sold several dishes weighing 11 lb. 4 oz. 16 dwt 11 gr. plates weighing three times as much; salts 2 lb. 5 oz. 6 dwt. 14 gr. tankards, 6 lb. 7 oz. 14 dwt. 17 gr. what is the weight of the whole?

Ans. 34 lb. 8 oz. 7 dwt. 3 gr.

A VOIR DU POIS WEIGHT.

By this weight are weighed things of a coarse, drossy nature, that are bought and sold by weight, and all metals but silver and gold. The denominations are,

16 drams (<i>dr.</i>) make	1 ounce,	oz.
16 ounces	1 pound,	lb.
28 pounds	1 quarter of an C.wt.	gr.
4 quarters, or 112 lb.	1 hundred weight,	C.wt.
20 hundred weight	1 ton,	T.

Note. 1. By the above table it appears, that 112 pounds make 1 C. wt. which are only given in some particular things; and from the best account ascertained at present, such are, all sugars, (except loaf) rice, alum, brimstone, copperas, flour, oat-meal, cocoa, race-ginger, chalk, log-wood, hay, iron, lead, madder, &c. In other articles, such as meat, cheese, butter, &c. likewise in Carolina rice, five score pounds are only given to the hundred.^c

2. Some things are bought and sold by the dozen, gross, &c. Hence,

12 particulars make	1 dozen,	doz.
12 dozen	1 common gross,	gro.
12 common gross, or 144 doz.	1 great gross,	g. gro.
20 particulars	1 score,	sco.

EXAMPLES.

T. C. gr. lb.	C. gr. lb. oz. dr.	C. gr. lb. oz. dr.
27 11 2 18	21 2 17 11 10	34 3 27 12 9
72 8 1 10	78 1 10 4 6	25 0 00 3 7
63 9 3 23	67 3 21 8 9	67 1 7 7 14
36 10 0 5	32 0 6 7 7	32 2 20 8 2
48 11 2 19	48 3 27 11 15	70 2 12 15 10
61 11 3 27	83 1 18 15 12	58 1 14 13 5

Application.

1. Suppose a merchant bought three hogsheads of sugar, weighing as follows, viz. No. 1, nine hundred, two quarters, eighteen pounds; No. 2, 8 hundred, 3 quarters, 12 pounds; No. 3, 7 hundred, 2 quarters, 19 pounds; how much is the amount?

Ans. 26 C. 0 qr. 21 lb.

2. Four boxes of spice, weighing as follow, viz. No. 1, one quarter, nineteen pounds, fourteen ounces, twelve drams; No. 2, two quarters, one pound, eleven ounces, ten drams; No. 3, 2 hundred, 2 quarters, 11 pounds, 14 ounces, 10 drams; No. 4, 3 quarters, 6 pounds, 9 ounces, 15 drams; what do they amount to?

Ans. 4 C. 1 qr. 12lb. 2oz. 15 dr.

3. How much is the weight of 5 casks of flour weighing as follow, viz. No. 1, 3 C. 2 qr. 18 lb. No. 2, 2 C. 3 qr. 12 lb. No. 3, 1 C. 3 qr. 19 lb. No. 4, 3 C. 3 qr. 7 lb. No. 5, 2 C. 1 qr. 18 lb.

Ans. 14 C. 2 qr. 18 lb.

4. Bought 6 bags of hops, weighing and numbered as follow, viz. No. 1, 2C. 2qr. No. 2, 2C. 1qr. 16lb. No. 3, 2C. 6qr. 3lb. No. 4, 2C. 3qr. No. 5, 2C. 1qr. 12lb. No. 6, 2C. 1qr. 16lb. required the amount? *Ans.* 14C. 1qr. 19lb.

5. Suppose a merchant bought 8 hogsheds of rice, one of which weighs twelve hundred, three quarters, seventeen pounds; the other two, each eleven hundred, no quarters, fourteen pounds; also 3 hogsheds of tobacco, each weighing seven hundred, three quarters, seventeen pounds; what weight has he to pay carriage for? *Ans.* 58C. 3qr. 12lb.

6. What quantity of hops is there in 6 bags, the first weighing 2qr. 15lb. and each of the rest 10lb. more? *Ans.* 4C. 1qr.

APOTHECARIES WEIGHT.

By this weight apothecaries mix their medicines; but buy and sell by avoirdupois weight.

The denominations are,

20 grains (gr.)	make	1 scruple, ℥
3 scruples		1 dram, ʒ
8 drams		1 ounce, ʒ
12 ounces		1 pound, lb

EXAMPLES.

lb	℥	ʒ	℥	gr.	lb	℥	ʒ	℥	gr.
6	7	4	1	11	13	10	6	2	13
3	4	3	1	9	76	1	1	0	7
8	9	2	2	14	61	8	4	1	11
1	2	3	0	6	38	8	3	1	9
8	11	7	2	13	28	11	7	2	19

Application.

If a druggist mix several simples together; 1st, 3 ounces, 4 drams, 1 scruple; 2nd, 4 ounces, 3 drams, 2 scruples; 3d, 4 drams, 18 grains; 4th, 6 ounces, 5 drams, 2 scruples, 18 grains; how much do they all weigh? *Ans.* 15℥ 23ʒ 00 16 gr

LONG-MEASURE.

Long Measure is used for lengths or distances.

The denominations are,

3 barley-corns (b. c.)	make	1 inch,	-	-	-	in.
12 inches	-	-	-	-	-	ft.
3 feet	-	-	-	-	-	yd.
5½ yards	-	-	-	-	-	P.
40 poles (or 220 yds.)	-	1 furlong,	-	-	-	Fur.
8 furlongs (or 1760 yds.)	-	1 mile,	-	-	-	M.
3 miles	-	1 league,	-	-	-	L.
60 geographic, or } miles		1 degree,	-	-	-	deg.
69½ statute }						

360 degrees the circumference of the earth.

Note. A hand is a measure of 4 inches, and particularly applied to measuring the heights of horses; and the fathom of six feet, to the depth of water.

EXAMPLES.

Deg.	M.	fur.	P.	Yds.	ft.	in.	b. c.
4	41	3	31	126	2	6	1
5	11	4	19	873	0	5	2
6	27	2	22	788	1	4	2
2	22	5	18	211	1	7	1
1	59	7	35	785	2	10	2
4	51	7	39	978	2	11	2

Application.

If from Philadelphia to the sign of the Blue Ball, be 20 miles, 3 furlongs, 30 perches; from thence to the Red Lion, 40 miles, 2 furlongs, 16 perches; from thence to Harris' Ferry 42 miles, 3 furlongs, 9 perches; from thence to Carlisle, 17 miles, and from thence to Pittsburg, 201 miles, 2 perches; how far is it from Philadelphia to Pittsburg?

Ans. 321m. 1f. 17p.

CLOTH MEASURE.

By this measure cloths, tapes, &c. are measured.

The denominations are,

2½ inches (in.)	make	1 nail,	-	-	-	na.
4 nails	-	1 quarter of a yard,	-	-	-	qr.
4 quarters	-	1 yard,	-	-	-	yd.
3 quarters	-	1 ell Flemish,	-	-	-	E. Fl.
5 quarters	-	1 ell English or French,	E. E.	E. Fr.		
2½ quarters or 10 nails	-	1 ell Hamburg,	-	-	-	E. H.

Compound Addition.

EXAMPLES.

Yds. qr. na.	E.Fl. qr. na.	E.E. qr. na.
77 2 3	41 2 3	66 4 3
72 1 1	58 0 1	33 0 1
68 3 3	36 1 3	48 3 3
31 0 1	63 1 1	51 1 1
97 3 3	68 2 3	78 4 3
38 3 1	43 1 3	91 4 3

Application.

1. There are 4 pieces of linen, viz. No. 1, 27 yards, 2 quarters, 3 nails; No. 2, 41 yards, 3 quarters, 3 nails; No. 3, 56 yards, 1 quarter, 2 nails; No. 4, 33 yards, 2 quarters, 1 nail; what quantity do they contain? *Ans.* 139 yds. 2 qr. 1 na.
2. Suppose a draper bought 10 bales of cloth, containing as follow, viz. No. 1, 2, each 328 yards, 2 nails; No. 3, 4, 5, each 407 yards, 3 quarters, 2 nails; and each of the rest 223 yards, 1 qr. 1 na.; the total is required? *Facit* 2996 yds. 1 qr. 3 na.

LAND MEASURE.

This measure shews the quantity of lands.

The denominations are,

9 square feet (Ft.)	make	1 yard,	Yd.
30½ yards	-	1 perch,	P.
40 perches	-	1 rood,	R.
4 roods	-	1 acre,	A.

EXAMPLES.

A.	R.	P.	A.	R.	P.	A.	R.	P.
46	2	23	362	2	18	365	0	11
53	1	16	637	1	22	534	3	29
63	3	31	786	2	30	379	1	16
86	0	8	713	1	10	620	2	24
49	3	39	476	3	28	239	0	36
76	2	31	367	2	29	431	0	14

Application.

1. If one field contain 27 acres, 3 roods, 27 perches, 94 grains; another 17 acres, 3 roods, 36 perches; and a third 41 acres, 9 roods, 16 perches; how much in all? *Ans.* 87 A. 10 R. 7 P.

2. Admit a man has one field of wheat containing thirty-seven acres, twenty-three perches; another of rye twenty-five acres, two roods; two pieces of pasture each seventeen acres, one rood, eleven perches; meadow twenty-one acres, fourteen perches; woodland forty-two acres, two roods, twenty-six perches; what quantity does he hold? *Ans.* 161A. OR. 5P.

LIQUID MEASURE.

This measure is used for beer, cider, wine, &c.

The denominations are,

2 pints (pt.) make	1 quart,	-	-	qt.
4 quarts	-	-	-	gal.
63 gallons	-	-	-	1 hogshead of wine or brandy, hhd.
2 hogsheads	-	-	-	1 pipe or butt, pi. or bt.
2 pipes, or 4 hhd.	1 tun,	-	-	T.

Note. By a law of Pennsylvania, 16 gallons make one half barrel; $31\frac{1}{2}$ gallons one barrel; 64 gallons one double barrel; 84 gallons one puncheon; 42 gallons one tierce.

EXAMPLES.

T. hhd. gal.	Gal. qt. pt.	Gal. qt. pt.
3 2 40	136 3 1	171 3 1
6 1 23	863 0 1	3828 0 1
7 3 34	868 2 1	625 2 1
3 0 29	531 1 1	3374 1 1
5 3 48	678 3 1	467 2 0
4 3 62	719 1 1	3530 0 1

Application.

1. Suppose a vintner bought 4 vessels of brandy, guaging as follows, viz. one hundred and twenty gallons, two quarts, one pint; two hundred and fifty-eight gallons; one hundred and thirty-six gallons; one hundred and eighteen gallons, one quart; how much do they contain? *Ans.* 632 gal. 3 qt. 1 pt.

2. Sold 6 hogsheads of cider, 4 of which contained each ninety-seven gallons, one quart; and each of the rest five gallons, two quarts, one pint more; how much do they all make? *Ans.* 594 gal. 3 qt.

DRY MEASURE.

This measure is used for grain, fruit, salt, &c.

The denominations are,

2 pints (pt.) make	1 quart,	qt.
8 quarts	-	1 peck,
4 pecks	-	1 bushel,

EXAMPLES.

Bu.	P.	qt.	Bu.	P.	qt.	Bu.	P.	qt.
63	2	5	376	1	6	3414	3	2
36	1	3	623	2	2	585	0	6
71	3	4	759	3	3	733	1	1
28	0	4	240	0	5	2266	2	7
67	3	6	786	3	7	3978	2	2
79	3	7	864	1	4	48	2	5

Application.

1. Add 14 bushels, 2 pecks, 5 quarts; 23 bushels, 3 pecks; 8 bushels, 7 quarts; 19 bushels, 1 peck, to a granary that contains 59 bushels, 4 quarts; and tell the amount? *Ans.* 125 bu.

2. Admit a man has six granaries, four of which contain 87 bushels, 2 pecks each, and the other two, one hundred bushels and seven quarts each, how much do they all contain?

Ans. 550bu. 1P. 6qt.

TIME.

The denominations are,

60 seconds (sec.)	make	-	1 minute,	-	Min.
60 minutes	-	-	1 hour,	-	H.
24 hours	-	-	1 day,	-	D.
7 days	-	-	1 week,	-	W.
4 weeks	-	-	1 month,	-	M.
13 months, 1 day, and 6 hours,	}	1 year,	-	-	Y.
or 365 days and 6 hours,			-	-	

Note. A common year consists of 365 days, and every fourth, called leap year, of 366.

The year is also divided into 12 calendar months, as follows.

The fourth, eleventh, ninth, and sixth,

Have thirty days to each affix'd:

And every other thirty-one,

Except the second month alone,

Which has but twenty eight in fine,

Till leap-year gives it twenty-nine.

EXAMPLES.

Y.	M.	W.	D.	Days.	H.	Min.	Sec.
567	10	1	3	317	20	41	56
542	12	2	4	627	3	18	4
712	4	3	5	762	17	14	13
386	8	0	2	737	13	45	47
786	12	3	6	466	16	46	20
714	11	1	6	683	17	39	58

Application.

1. What day of the year was the 29th of the eighth month, 1789? *Ans.* 241st.

2. From the 2d of the third month, to the 19th of the eleventh month inclusive how many days? *Ans.* 263 days.

3. Admit A to be 27 years, 5 months, 2 weeks old; B 25 years; C 20 years, 7 months, 3 weeks, 4 days; D 17 years, 4 days; E and F 14 years, 11 months, 1 week each; G 12 years, 1 month, 6 days; what is the sum of their ages?

Ans. 131 y. 11 m. 1 w

MOTION OR CIRCLE MEASURE.

This is used by astronomers, navigators, &c.

The denominations are,

60 seconds (") make - - - 1 minute,
 60 minutes - - - - - 1 degree,
 30 degrees - - - - - 1 sign, sig.
 12 signs, or 360 degrees, one revolution or circle.

EXAMPLES.

				sig.			
6	28	43		1	14	46	51
3	31	17		1	15	13	9
8	20	30		1	12	18	27
1	39	30		1	17	41	83
9	59	49		1	19	59	59
7	45	41		1	17	39	43

COMPOUND SUBTRACTION.

COMPOUND SUBTRACTION teaches to take one quantity of several denominations, from a greater of like quality.

RULE.

Place the quantities as in Compound Addition, with the less under the greater; then begin at the right hand, and take the under from the upper; but when the lower number is greater than the upper, take it from as many of that denomination as will make one of the next greater, and to the remainder add the upper number; set down the result, and carry one to the next, &c.

PROOF, as in Integers.

Compound Subtraction.

MONEY.

EXAMPLES.

	<i>l.</i>	<i>s.</i>	<i>d.</i>		<i>l.</i>	<i>s.</i>	<i>d.</i>
From	473	14	8½		6714	18	1½
Take	167	16	4½		1896	9	8½
	<hr/>				<hr/>		
Rem.	308	18	4½				
	<hr/>				<hr/>		
Proof,	473	14	8½				
	<hr/>				<hr/>		
	<i>l.</i>	<i>s.</i>	<i>d.</i>		<i>l.</i>	<i>s.</i>	<i>d.</i>
Borrowed	670	10	0½		4789	0	10
aid	187	18	2		4089	17	4½
	<hr/>				<hr/>		

Application.

Suppose A indebted to the brewer one hundred and thirty-eight pounds, fourteen shillings and six pence, B 87*l.* 16*s.* 4½*d.* much does one owe more than the other?

Ans. 50*l.* 18*s.* 1½*d.*

The brewer and baker drew bills each upon the other; the brewer stands indebted seven hundred, fifty-six pounds seven-shillings; the baker 437*l.* 17*s.* 8½*d.* what is the balance, in whose favour?

Ans. 318*l.* 19*s.* 3½*d.* in the baker's.

Suppose A owes 2000*l.* whereof he pays at one time 499*l.* 11½*d.* and at a second payment 1388*l.* 18*s.* 11*d.* what is residue?

Ans. 1111*l.* 1*s.* 1½*d.*

FEDERAL MONEY.

EXAMPLES.

<i>E.</i>	<i>D.</i>	<i>d.</i>	<i>c.</i>	<i>m.</i>	<i>D.</i>	<i>c.</i>	<i>E.</i>	<i>D.</i>	<i>d.</i>	<i>c.</i>	<i>m.</i>
1	4,	1	2	9	749	42	347	5,	0	7	2
	7,	9	0	2	403	09	294	2,	8	6	5
	<hr/>							<hr/>			
	6,	2	2	7							
	<hr/>							<hr/>			
1	4,	1	2	9							
	<hr/>							<hr/>			

Application.

sent 4700 dollars to the bank; and having drawn checks dollars, 15 cents, 109 dollars, 37 cents, and 7 dollars, 2 mills; what further sum may I draw for?

Ans. 4485*D.* 46*cts.* 8*m.*

2. From 75 dollars, deduct 7 dollars 50 cents, and 5 mills.

Facit 67D. 49c. 5m.

3. Admit A have owing to him on bond, 795 dollars, 44 cts. and interest due thereon 193 dollars, 36 cents, and receives in part pay, viz. 198 dollars, 75 cents, 279 dollars, 25 cents, 199 dollars, 87½ cents, 99 dollars, 37½ cents; what sum remains unpaid?

Ans. 211 dolls. 55 cts.

4. Paid A. B. for C. D.'s bill of 75 dollars, viz. gave him R. Drawer's note for 8 dollars, 67 cents, J. Johnson's do. for 5 dollars, an assignment on R. Dealer for 18 dollars, 69 cents, in Bank notes 40 dollars; how much cash will make up the deficiency?

Ans. 2 dolls. 64 cts.

5. A and B have each a sum of money; A's sum, which is the greatest, is 75 dollars, 34 cents, and the difference is 50 dollars, 79 cents; what money had B?

Ans. 24 dolls. 55 cts.

6. A person left 25111 dollars, 9 cents, between his son and daughter; the daughter was to have eleven thousand eleven hundred and eleven dollars, and 11 cents; what was the son's legacy?

Ans. 12999 dolls. 98 cts.

7. A trader failing, was indebted to A 72 dollars, 67 cents, to B 35 dollars, 30 cents, to C 18 dollars, 49 cents, to D 44 dollars, to E 67 dollars, to F 11 dollars, 31 cents, to G 19 dollars, 19 cents, to H 20 dollars; and at the same time he had by him in cash 4 dollars, 30 cents, in commodities 24 dollars, 33 cents, in household furniture 21 dollars, 92 cents, in a tenement 58 dollars, 65 cents, in recoverable book debts 88 dollars, 84 cents: Now, supposing these effects all surrendered to his creditors, what will they lose by him?

Ans. 89 dolls. 92 cts.

TROY WEIGHT.

EXAMPLES							
lb.	oz.	dwt.	gr.	lb.	oz.	dwt.	gr.
From 27	0	11	10	48	10	6	17
Take 9	8	1	18	19	9	19	21
<hr/>				<hr/>			
Rem. 17	4	9	16				
<hr/>				<hr/>			
Proof 27	0	11	10				
<hr/>				<hr/>			

Application.

1. From 637lb. 9oz. 8gr. taking 238lb. 10oz. 9dwt. 20gr. what remains?

Ans. 348lb. 10oz. 10dwt. 12gr.

2. Bought 3 ingots of silver, weighing 204lb. 6oz. 10dwt. sold two of them weighing 108lb. 6oz. 11dwt. 13gr. the weight of the other is required?

Facit 95lb. 11oz. 18dwt. 11gr.

AVOIRDUPOIS WEIGHT

EXAMPLES.

T.	C.	qr.	lb.	T.	C.	qr.	lb.	C.	qr.	lb.	oz.	dr.
48	16	2	21	52	12	3	15	17	1	12	14	15
19	18	1	27	24	14	2	26	6	3	21	15	9

Application.

1. Bought 45C. 1qr. 7lb. of sugar; and sold 39C. 20lb. what remains? *Ans.* 6C. 15lb.

2. From 17T. 7C. 2qr. taking 12C. 3qr. 9lb. what remains? *Ans.* 16T. 14C. 2qr. 19lb.

3. Bought 6 casks of flour, each weighing 1C. 3qr. 12lb. tare per bbl. 17lb. how much neat weight? *Ans.* 10C. 26lb.

4. Sold 4 hogsheads of sugar, two of which weighed 37C. 3qr. gross, tare 3qr. 17lb. the other two each 13C. 2qr. 4lb. tare 1qr. 10lb. each; the neat weight is required?

Facit 63C. 27lb.

APOTHECARIES WEIGHT.

EXAMPLES.

lb	3	3	3	gr.	lb	3	3	3	gr.
9	1	2	2	12	28	10	4	1	10
6	10	1	1	19	17	6	7	2	8

Application.

1. From 3 pounds, 3 ounces, 1 dram, 1 scruple, 12 grains, taking 1 pound, 7 ounces, 0 dram, 2 scruples, 18 grains, what is left? *Ans.* 1 pound, 8 ounces, 0 dram, 1 scruple, 14 grains.

2. If out of 17 pounds, 14 ounces, 6 drams, 2 scruples, of medicine, be taken three parcels, each 3 pounds, 5 ounces, 4 drams, 1 scruple, 17 grains; what quantity is left?

Ans. 7 pounds, 7 ounces, 0 dram, 2 scruples, 9 grains.

LONG MEASURE.

EXAMPLES.

Deg.	M.	fur.	P.	Yds.	ft.	in.	b.c.	Yds.	ft.	in.	b.c.
21	41	6	21	367	2	1	2	322	1	7	1
19	36	7	36	191	2	8	1	245	2	3	2

Application.

1. From 50L. 2M. 1fur. take 19L. 18P. 4yds.

Facit 31L. 2M. 21P. 14yd.

2. Two persons, B and C, being 327 miles distant, and intending to meet, journey as follows : B travels the first day 21M. 5 fur. the second 40M. 26P. the third but 5M. 4 fur. C goes the first day 60M. the second 57M. 35P. the third 52M. 6 fur. how many miles have each travelled, and how far are they then asunder ?

	M.	fur.	P.
<i>Answer</i> { B.....	67	1	26
C.....	169	6	35
Asunder.....	89	7	19

CLOTH MEASURE.

EXAMPLES.

Yds. qr. na.	E.Fl. qr. na.	EE. qr. na.
47 2 1	42 1 1	85 4 2
19 3 2	19 2 3	18 4 3
<hr/>	<hr/>	<hr/>

Application.

1. From 156 E. E. take 50E. 1qr. 1na. *Facit* 105E. 3qr. 3na.

2. From 856yds. take 200yds. 2qr. 1na. 1in.

Facit 655yds. 1qr. 2na. 1½in.

3. From 4 pièces of cloth, each 27yds. 2qr. 3na. having cut 87yds. 3qr. 3na. how many yards are left ?

Ans. 22yds. 3qr. 1na.

4. Bought 3 pieces of cloth, each containing 42yds. of which were sold one piece, and 27yds. 1qr. 2na. of another; what quantity remains ?

Ans. 56yds. 2qr. 2na.

LAND MEASURE.

EXAMPLES.

A. R. P.	A. R. P.	A. R. P.
87 2 17	90 3 27	500 0 00
19 3 29	27 2 21	174 2 21
<hr/>	<hr/>	<hr/>

Application.

1. From 780A. 2R. take 396A. 2R. 15P.

Facit 383A. 3R. 25P.

3. If a tract of land containing 4780A. 3R. 30P. be divided among three persons, A, B, and C, viz. A to have 1784A. 3R. 24P. B 1658A. 2R. 36P. Query C's share?

Facit 1337A. 1R. 10P.

3. A man purchased these several tracts of land, viz. 47A. 174A. 37P. 200A. 3R. 470A. 3R. and sold thereof 300A. 27P. and at a second sale 275A. what quantity has he left?

Ans. 317A. 2R. 10P

LIQUID MEASURE.

EXAMPLES.

T. hhd. gal.

27 1 41

19 3 19

T. hhd. gal.

29 3 40

16 2 27

Hhd. gal. qt. pt.

17 28 1 0

9 36 2 1

Application.

1. From 2 tuns of wine, take 3 hhds. 15 gal. 3 qt.

Facit 1T. 47 gal. 1 qt

2. Bought several vessels of cider, containing 10007 gal. of which 4005 gal. 2 qt. 1 pt. were sold; what quantity is remaining?

Ans. 6001 gal. 1 qt. 1 pt.

3. Bought of A 174 gal. 3 qt. of wine; of B twice as much, and 7 gal. 1 pt.; of C as much as from A and B both; of which were sold to D 197 gal. 1 pt.; to E three times as much, and 10 gal. 3 qt. more. Query the remainder. *Facit* 263 gal. 2 qt.

DRY MEASURE.

EXAMPLES.

Bu. P. qt.

28 1 6

9 3 1

Bu. P. qt.

341 3 6

298 1 2

Bu. P. qt.

471 3 4

198 2 7

Application.

1. From 27bu. 1P. take 18bu. 2P. 1pt.

Facit 8bu. 2P. 7qt. 1pt.

2. What is the difference between 1000bu. 7qt. and 734bu. 1P. 5qt.?

Ans. 265bu. 3P. 2qt.

3. Out of a granary containing 500bu. taking 375bu. 2P. 6qt. what quantity must remain?

Ans. 124bu. 1P. 2qt.

TIME.

EXAMPLES.

Y.	M.	W.	D.	D.	H.	Min.	Sec.
1789	5	1	3	364	23	59	58
987	12	3	6	198	23	59	59

Application.

1. From 200 years, take 98y. 3m. 8h. 10sec.

Facit 101y. 9m. 8w. 6d. 15h. 59m. 50sec

2. An indented servant had 6 years to serve; and when he had continued 5y. 8m. 3w. 4d. query, the remainder of his time?

Facit 4m. 3d.

3. Jacob by contract was to serve Laban for his two daughters 14 years; and when he had accomplished 11y. 11m. 11w. 11d. the remaining time is required.

Facit 1y. 11. lun. m. 3w. 3d.

Note 1: The interval of time according to the calendar, between two given dates, may be usefully and easily obtained thus: Subtract the prior date from the latter; borrowing as many days as make the month in the subtrahend, and mentally adding 12 to that of the minuend, when necessary; carrying one in either case, to the next name, as usual.

2nd: When one of the dates is in the old style, and the other in the new, 2 months and eleven days must be taken from the difference.

4. How much older is Jesse than Anna, his birth being on the 20th of the 12th month, 1778, and hers the 10th of the 8th month, 1783?

Y.	m.	d.
1783	8	10
1778	12	20

Ans. 4 7 21

5. A was born the 21st day of the 2d month, 1765; B the 9th of the 4th month, 1771; what is the difference of their ages?

Ans. 6y. 1m. 16d.

6. A bond was given the 22d of the second month, 1787; and taken up the 12th of the 10th month, 1789; for what time must interest be computed thereon?

Ans. 2y. 7m. 18d.

7. A was born the 26th day of the second month, 1775; B on the 21st day of the ninth month, 1777; C on the 25th of the 12th month, 1778; what is the difference of the ages of A and B; of B and C; also of A and C; and when will they respectively be 21 years of age?

y. m. d.

Difference { A & B 2 6 28 A on the 26th of the 2d. mo. 1796
 B & C 1 3 4 B on the 21st of the 9th mo. 1798
 A & C 3 9 27 C on the 25th of the 12th mo. 1799

8. A was born on the 13th day of the sixth month, 1746, old style; B on the 16th of the sixth month, 1764 new style; what difference is there in their ages, and how old is each man on the 1st day of the year 1790?

Answer { Difference 17y. 9m. 22d.
 A's age 43y. 4m. 7d.
 B's age 25y. 6m. 15d.

MOTION.

EXAMPLE.

sig.	sig.	sig.
10 41 52	10 18 49 12	41 16 50 14
6 48 19	6 20 21 46	9 17 32 48

Application.

- From 7sig. $21^{\circ} 27' 51''$ take 3sig. $12^{\circ} 51' 57''$.
Facit 4sig. $8^{\circ} 25' 54''$
- When a planet has moved through 9sig. $9^{\circ} 9' 9''$ of its orbit, how much is it short of a complete revolution?
Ans. 2sig. $20^{\circ} 50' 51''$

DECIMAL FRACTIONS.

A DECIMAL Fraction is a part, or parts of an unit, denoted by a point prefixed to a figure, or figures, thus, .4, .45, .456: the first figure after the point, denotes so many tenths of an unit; the second so many hundredths of an unit, or tenths of one tenth; which are equal to, and read as $\frac{4}{10}$, $\frac{45}{100}$, $\frac{456}{1000}$.

A mixt number consists of a whole number and a decimal thus, 245.789; which is, $245\frac{789}{1000}$.

As whole numbers, counting from the right to the left, increase in a ten-fold proportion : so decimals counting towards the right, decrease in the same proportion : as is exemplified in the following :

TABLE.

6	C. of Millions	1	Tenth Part
8	X. of Millions	2	Hundredth Part
7	Millions	3	Thousandth Part
9	C. of Thousands	4	X. Thousandth Part
5	X. of Thousands	5	C. Thousandth Part
4	Thousands	6	Millionth Part
3	Hundreds	7	X. Millionth Part
2	Tens	8	C. Millionth Part
1	Units	9	Thousand Millionth Part
		} of an Unit {	
		or {	
		6	Tenths of 1 Tenth Part
		5	Tenths of 1 Hundredth Part
		4	Tenths of 1 Thousandth Part
		3	Tenths of 1 X. Thousandth Part
		2	Tenths of 1 C. Thousandth Part
		1	Tenths of 1 Millionth Part
		8	Tenths of 1 X. Millionth Part
		7	Tenths of 1 C. Millionth Part
		6	Tenths of 1 X. Millionth Part
		} of an Unit {	
1	Dollar		
1	Tenth of a Dollar, or 10 Cents		
1	Hundredth of a Dollar, or 1 Cent		
1	Thousandth of a Dollar or 1 Mill.		

Note 1. Cyphers annexed to decimals, neither increase nor decrease their value; thus .25000 and 25 are equal: but prefixed, decrease them in a ten-fold proportion, thus .5, .05, .005, all express different decimals, and $= \frac{5}{10}, \frac{5}{100}, \frac{5}{1000}$.

2. When the parts of a dollar are expressed decimally by several figures, the two first after the point are cents, the third mills, and the fourth tenths of a mill, &c.
3. When several figures stand together, and denominated cents, the first two to the right hand are cents, and the remainder dollars.
4. When several figures stand together, and denominated mills, the first figure on the right hand is mills, the next two, cents, and the remainder dollars.

		Eagle	Dol.	Dol.	Cents	Dol.
		1	= 10	& 1	= 100	= .1
				$\frac{3}{4}$	= 75	= .75 or 7 dimes 5 cents.
				$\frac{1}{2}$	= 50	= .50 or 5 dimes.
				$\frac{1}{4}$	= 25	= .25 or 2 dimes 5 cents.
Called	{ Eleven-penny } piece.			$\frac{1}{8}$	= 12½	= .125 = 12 cents, 5 mills. or 1 dime, 2 cents, 5 mills.
	{ Five-penny } piece.			$\frac{1}{16}$	= 6¼	= .0625 or 6 cents, 2 mills, and an half.

Note. To set the parts of a dollar decimally—make the point before the cents; but if the cents be less than ten, supply the tenth's place with 0: and if no cents, put 00, &c. after the point: then all the figures in rotation.

ADDITION OF DECIMALS.

RULE.

Place the numbers according to their value; viz. units under units, tenths under tenths, &c. and add as in addition of integers; putting the point in the sum total, exactly under those in the example.

EXAMPLES.

Yards.
947.621
576.71
2718.94
619.473
21.66
7.8

4892.204

Pounds.
763.6821
38.718
6.64
37.86
3.4782
7.36

Application.

1. What is the sum of $450 + 31.47 + 376.004 + 10.8 + 456 + 76 + .05$? *Ans.* 1325.084

2. If $2476.8471 + 94.9 + 9.8941 + 867.05 + 84.9 + 271.007 + 5.1008 + 1.6789$ be added together, what is the sum? *Ans.* 3811.3779

3. Add two dollars and one quarter, one dollar and one eighth, one half dollar, and one sixteenth together, and tell their sum? *Ans.* 3.9375 dol. = 3 dol. 93 cts. 7.5 mills.

4. Bought in market one turkey, for three quarters of a dollar, one goose for a half a dollar; one pound of butter for one quarter of a dollar; onions eleven-penny piece; half a peck of potatoes, half a peck of apples, and one quart of cranberries, for a five-penny piece each. How much do they come to? *Ans.* 1.8125 dol. = 1 dol. 81 cts. 2.5 mills.

SUBTRACTION OF DECIMALS.

RULE.

Place the numbers as in addition, with the least under the greatest: and in the difference, set the point directly under those in the example.

EXAMPLES.

Yards.	Gallons.	Miles.	Acres.
576.271	3618.218	24611.1	6827.4681
89.7167	1981.85	9716.701	6018.91
<hr/> 486.5543	<hr/>	<hr/>	<hr/>

Application.

1. From 100.17 take 84.476 and what is left? *Ans.* 15.694

2. What is the difference between the sum of $841.46 + 109.63 + 34.691$, and of $478.462 + 37.66 + 378.8$? *Ans.* 90.849

3. From 73.42 dol. take 8.267 dol. and what remains?

Ans. 65 dol. 15 cts. 3 mills.

4. Borrowed 326 dols. 78 cts. and paid 105 dols. 32 cts. 6 mills; how much remains?

Ans. 221 dol. 45 cts. 4 mills.

5. Sent a servant to market with 3 dols. to buy provisions, who bought meat 60 cts. butter 32 cts. cheese 86 cts. and fowls 37 cts. 5 mills; how much change must he return?

Ans. .845 dol. = 84 cts. 5 mills.

MULTIPLICATION OF DECIMALS.

RULE.

Multiply as in Integers, and point off as many decimal places in the product, as are in both the factors.

Note 1. If decimal places be wanting in the product, supply them with cyphers between the decimal point, and figures in the product.

2. Multiplication in decimals may be contracted thus:

Set the unit's figure of the multiplier, under such place of the multiplicand as is to be the lowest retained in the product; and place all the remaining figures of the multiplier in an inverted order; in multiplying, begin with the figure in the multiplicand which stands over the multiplying figure, adding the increase which may arise, by carrying one for the first five, and one more for every ten after, and place the product so that the right hand figures stand under each other.

EXAMPLES.

1. Multiply 743.56815 by 52.647.

Contracted, and to retain three decimal places.

743.56815
52.647

743.56815
746.25

520497705

37178408

297427260

1487136

446140890

446141

148713630

29742

871784075

5205

Facit 89146.63239305

Facit 39146.532

2. Multiply 79.347 by 23.15 *Facit* 1836.88305
3. Multiply .63478 by .8264 .524582192
4. Multiply 3.141592 by 52.7438 165.6995001296
5. Multiply .385746 by .00463 .00178600398
6. Multiply .002534 by .09256 .00008250704
7. How much is 78 times 46.57 dols. *Ans.* 3632 dols. 46cts.
8. Bought 386.5 bushels of wheat at one dollar and a quarter per bushel; how much do they come to?
Ans. 483.125 dol. = 483 dols. 12 cts. 5 mills.
9. Suppose 234 men each subscribe 65 dols. and three quarters, to defray the expense of a building; how much did it cost?
Ans. 15385.5 dols.
10. Sold 462 yards of cloth, for two dols. and one eighth per yard; how much came they to? *Ans.* 981 dols. 75 cts.
11. Bought 186.5 yards of Holland, at one dollar and one sixteenth per yard; how much is the bill?
Ans. 198.15625 dols. = 198 dols. 15 cts. 6.25 mills.

DIVISION OF DECIMALS.

Note. The decimal places in the dividend, must always be equal to those in the divisor.

RULE.

When the dividend has not as many decimal places as the divisor, or will not contain it, annex cyphers to supply the defect; then divide as in integers; and point off in the quotient as many decimal places as are in the dividend more than in the divisor.

Note. If decimal places be wanting in the quotient, supply them with cyphers between the point, and the figures in the quotient.

When there are many figures in the divisor, the operation may be contracted thus:

Find what place of integers, or decimals, the first figure of the quotient will possess; and consider how many quotient figures will serve the present purpose; then take the same number of the left hand of the divisor, and as many of the dividend will contain them (less than ten times) rejecting the rest; then, instead of bringing figures down from the dividend, separate one from the right of the divisor, as often as necessary, till the whole be exhausted; remembering to car-

ry from the right hand figures of the divisor, as in contracted multiplication.

When there are not so many figures in the divisor, divide as usual, till there be as many of the quotient figures found as the divisor is short of the intended quotient; then use the contraction.

EXAMPLES.

1. Divide 2508.92806 by 92.41035

92.41035)2508.92806(27.1498 + Facit.

18482070

66072106

64687245

13848610

9241035

46075750

36964140

91116100

83169315

79467850

73928280

5539570

Contracted, so as to have four decimal places in the quotient.

92.4103,5)2508.92806(27.1498 + Facit.

1848207

660721

646872

13849

9241

4608

3696

912

832

80

74

6

2. Divide 1836.88305 by 23.15 *Facit* 79.347
 3. Divide 3673.7661 by 158.694 23.15
 4. Divide 234.70525 by 64.25 3.653
 5. Divide 9. by .9 10.
 6. Divide .9 by 9. .1
 7. Divide .3 by 3. .1
 8. Divide .00178600398 by .00463 .385746
 9. Suppose 3632.46 dols. to be divided into 78 equal parts ;
 how much is each part ? *Ans.* 46 dols. 57 cts.
 10. Bought 386.5 bushels of wheat, for 483.125 dols. how
 much per bushel ? *Ans.* 1 dol. 25 cts.
 11. Suppose a certain building to cost 15385.5 dols. and to
 be paid by 234 men ; how much must each pay ?
Ans 65 dols. 75 cents.
 12. Sold 462 yards of cloth, for 981.75 dols. how much per
 yard ? *Ans.* 2 dols. 12 cts. 5 m.
 13. Bought 186.5 yards of Holland, for 198.15625 dols. how
 much per yard ? *Ans.* 1 dol. 6 cts. 2.5 m.
Note. The last five questions, prove the last five in Multipli-
 cation.

COMPOUND MULTIPLICATION.

COMPOUND MULTIPLICATION teaches to multiply numbers of quantities consisting of divers denominations: also, to find the amount of any quantity at the given price of an integer.

GENERAL RULE.

Place the multiplier under the lowest denomination of the given quantity ; then multiply it as in integers, and divide the product by as many of this denomination as will make one of the next greater ; set down the remainder (if any) underneath, and add the quotient to the product of the next denomination, and so proceed.

Note. In multiplying money, the learner may be taught to perform it without using division, by having the pence-table perfectly committed to memory, and multiplying the shillings as in integers, carrying half the number of tens to the product of pounds, and prefixing the odd ten (if any) to the unit's place under shillings

PROOF.

Multiply double the compound quantity or price, by half the multiplying integers; or half the former, by double the latter; or invert the multipliers when more than one.

EXAMPLES.

£.	s.	d.	£.	s.	d.	£.	s.	d.	£.	s.	d.
24	16	4	22	8	2	987	18	11½	493	19	5½
		2			4			6			12

49 12 8

E.	D.	d.	c.	m.	Dols.	Cts.	D.	d.	c.	m.	D.	d.	c.	m.
84	7,	7	4	2	439,	17	9,	0	4	5	7,	3	6	8
				6		7				29				30

508 6, 4 5 2

Note. Federal Money may be multiplied as whole numbers, by any number whatsoever, observing to separate by a point, as many places to the right hand of dollars, in the product, as are in the sum so multiplied.

lb.	oz.	dwt.	gr.	T.	C.	qr.	lb.	oz.	dr.	lb.	3	3	3	gr.
9	10	17	21	6	17	3	21	14	15	3	11	7	2	13
			2						3					4

Deg. M. fur. P.
6 54 7 36
5

Yds. ft. in. b.c.
187 2 7 2
6

Yds. qr. na.
48 3 2
7

E.F. qr. na.
124 1 3
8

E.E. qr. na.
68 4 1
9

A. R. P.
78 3 36
10

T. hd. G. qt. pt.
4 3 57 3 1
11

Bu. P. qt.
38 3 7
12

Y. m. w. d.
476 10 2 6
12

D. h. m. sec.
36 21 48 56
6

sig. ° ' "
1 24 48 25
4

sig. ° ' "
10 27 50 42
3

CASE 1.

When the given quantity does not exceed 12.

RULE.

Multiply the price of an integer by said quantity, and the product will be the answer.

EXAMPLES.

1. Multiply 3 6 by 4

$\begin{array}{r} \text{s. d.} \\ 3 \text{ } 6 \\ \times 4 \\ \hline 14 \text{ } 0 \end{array}$

Double price
Half multiplier

$\begin{array}{r} \text{s. d.} \\ 3 \text{ } 6 \\ \times 2 \\ \hline \end{array}$

$\begin{array}{r} 7 \text{ } 0 \\ 2 \\ \hline \end{array}$

Proof 14 0

2. Multiply $\begin{array}{r} \text{£. s. d.} \\ 0 \text{ } 7 \text{ } 6 \end{array}$ by 5 }
 $\begin{array}{r} 0 \text{ } 3 \text{ } 9 \end{array}$ by 10 }
 3. $\begin{array}{r} 1 \text{ } 18 \text{ } 6 \end{array}$ by 6 }
 $\begin{array}{r} 0 \text{ } 19 \text{ } 3 \end{array}$ by 12 }
 4. $\begin{array}{r} 0 \text{ } 2 \text{ } 10\frac{1}{2} \end{array}$ by 3 }
 $\begin{array}{r} 0 \text{ } 0 \text{ } 11\frac{1}{2} \end{array}$ by 9 }
 5. $\begin{array}{r} 2 \text{ } 14 \text{ } 8\frac{3}{4} \end{array}$ by 11 }
 6. $\begin{array}{r} 0 \text{ } 9 \text{ } 11\frac{1}{4} \end{array}$ by 4 }
 $\begin{array}{r} 0 \text{ } 3 \text{ } 3\frac{3}{4} \end{array}$ by 12 }

$\begin{array}{r} \text{£. s. d.} \\ 17 \text{ } 6 \end{array}$
 11 11 0
 0 8 7 $\frac{1}{2}$
 30 2 0 $\frac{1}{4}$
 1 19 9

Note 1. When the price of an integer is Mills, multiply as in integers, and separate the right hand figure in the product for Mills, the next two for Cents, and the remainder will be Dollars. Or, point the price in the decimal parts of a dollar, and the product as in Multiplication.

2d, When the price of an integer is cents only, multiply as before, and separate two figures to the right hand in the product for Cents, and the remainder will be Dollars. Or, point the price and the product as before.

3d, When the price of an integer is one or more Dollars, and parts of a Dollar, observe the rules in Multiplication of Decimals. If the Cents be less than ten, supply the tenth's place with 0, and if Mills only, supply the Cent's place with 00.

EXAMPLES.

1. 642 at 5 mills each. *Ans.* 3 dol. 21 cts.
2. 480 at 8 mills each. *Ans.* 3 dol. 84 cts.
3. 306 at 17 mills, or 1 ct. 7 m. *Ans.* 5 dol. 20 cts. 2 m.
4. 120 at 34 mills, or 3 cents, 4 mills. *Ans.* 4 dol. 8 cts.
5. 74 at 7 cents. *Ans.* 5 dol. 18 cts.
6. 49 at 16 cents. *Ans.* 7 dol. 84 cts.
7. 341 at 1 dol. 45 cents. *Ans.* 494 dol. 45 cts.
8. 214 at 2 dol. 4 cents. *Ans.* 436 dol. 56 cts.
9. 36 at 3 dol. 7 mills. *Ans.* 108 dol. 25 cts. 2 m.
10. 317 at 2 dol. 12 cents, 5 mills. *Ans.* 673 dol. 62 cts. 5 m.

CASE 2.

When the given quantity exceeds 12, and is the exact product of some two factors in the Multiplication table;

RULE.

Multiply the given price of an integer by one of said factors, and the product of that by the other; the last product will be the answer.

EXAMPLES.

	£. s. d.		£. s. d.
1. 14 yards at	0 17 6		0 17 6
	$2 \times 7 = 14$		7
	<hr/>		<hr/>
	1 15 0		6 2 6
	7		2
	<hr/>		<hr/>
	12 5 0	Proof	12 5 0
	<hr/>		<hr/>
	£. s. d.		£. s. d.
2. Multiply	0 7 10 by 16	Fact	6 5 4
	0 3 11 by 32		
	1 2 10½ by 27		30 17 11½
3.	0 11 5½ by 54		
	0 17 11½ by 50		44 17 11
4.	0 8 11½ by 100		
	7 9 6 by 66		493 7 0
5.	3 14 9 by 132		
	9 18 11½ by 72		716 5 0
6.	4 19 5½ by 144		

Note. Observe the notes in Case 1.

1. 568 at 50 mills each. *Ans.* 2 dol. 81 cts. 5 m.
2. 704 at 43 mills, or 4 cents 3 mills. *Ans.* 30 dol. 27 cts. 2 m.
3. 360 at 8 cents. *Ans.* 28 dol. 80 cts.
4. 194 at 52 cents. *Ans.* 100 dol. 88 cts.
5. 75.3 at 4 dol. 35 cts. *Ans.* 328 dol. 42 cts. 5 m.
6. 186 at 2 dol. 7 cents. *Ans.* 385 dol. 2 cts.
7. 93.25 at 3 dol. 8 mills. *Ans.* 280 dol. 49 cts. 6 m.

CASE 3.

When the given quantity is not the exact product of any two factors in the Multiplication table;

RULE.

Use two such factors as will produce the nearest to the given quantity, and add or subtract for the deficiency or excess.

EXAMPLES.

1. Multiply $\begin{matrix} s. & d. \\ 3 & 8 \times 1 \end{matrix}$
by 19 $3 \times 6 + 1 = 19$

$$\begin{array}{r} 11 \ 0 \\ 6 \\ \hline \end{array}$$

$$\begin{array}{r} 3 \ 6 \ 0 \\ 3 \ 8 \\ \hline \end{array}$$

Facit 3 9 8

$$\begin{matrix} s. & d. \\ 3 & 8 \times 1 \\ 6 \end{matrix}$$

$$\begin{array}{r} 1 \ 2 \ 0 \\ 3 \\ \hline \end{array}$$

$$\begin{array}{r} 3 \ 6 \ 0 \\ 3 \ 8 \\ \hline \end{array}$$

Proof 3 9 8

2. Multiply $\begin{matrix} £. & s. & d. \\ 0 & 17 & 8 \end{matrix}$ by 43 }
 $\begin{matrix} 0 & 2 & 10 \end{matrix}$ by 86 }
 3. $\begin{matrix} 0 & 0 & 9\frac{1}{2} \end{matrix}$ by 58 }
 $\begin{matrix} 0 & 0 & 4\frac{1}{4} \end{matrix}$ by 116 }
 4. $\begin{matrix} 0 & 12 & 8 \end{matrix}$ by 74 }
 $\begin{matrix} 0 & 6 & 4 \end{matrix}$ by 148 }
 5. $\begin{matrix} 0 & 15 & 11\frac{1}{2} \end{matrix}$ by 76 }
 $\begin{matrix} 0 & 7 & 11\frac{1}{4} \end{matrix}$ by 152 }
 6. $\begin{matrix} 8 & 7 & 0 \end{matrix}$ by 78 }
 $\begin{matrix} 4 & 3 & 6 \end{matrix}$ by 156 }

$\begin{matrix} £. & s. & d. \\ 37 & 19 & 8 \end{matrix}$ Facit

2 5 11

46 17 4

60 12 10

651 6 0

Note. Observe the Notes in Case 1.

1. 713.4 at 9 mills; *Ans.* 642 cts. 06 m.
2. 561 at 7 cents, 6 mills; *Ans.* 42 dol. 63 cts. 6 m.
3. 189.7 at 5 cents; *Ans.* 9 dol. 48 cts. 5 m.
4. 68.75 at 2 dol. 47 cents; *Ans.* 169 dol. 81 cts. 2.5 m.
5. 112.25 at 3 dol. 4 cents, 8 mills; *Ans.* 342 dol. 13 cts. 8 m.
6. 378 at 1 dol. 6 mills; *Ans.* 380 dol. 26 cts. 8 m.

CASE 4.

When the given quantity is greater than the product of any two factors in the table;

RULE.

Multiply continually by as many tens less one, as there are figures in the given quantity; then multiply the last product by the figure in the left of the said quantity (if more than one;) again, multiply the figure in the unit's place into the given price; and that in the ten's place into the price of tens &c. place the several products as in addition, and their sum will be the answer.

EXAMPLES.

1. Multiply $6\frac{1}{2} \times 6$
by 176

d.
10

5 5 × 7
10

2 14 2
1 17 11
3 3

Facit 4 15 4

Multiply $3\frac{1}{2}$
by 352 4 × 8 × 11 = 352

1. 1
8

8 8
11

Facit 4 15 4

2. Multiply $\begin{matrix} \text{£.} & \text{s.} & \text{d.} \\ 0 & 1 & 2 \end{matrix}$ by 195 }
 $\begin{matrix} 0 & 0 & 7 \end{matrix}$ by 390 }
 $\begin{matrix} 0 & 3 & 3 \end{matrix}$ by 407 }
3. $\begin{matrix} 0 & 1 & 7\frac{1}{2} \end{matrix}$ by 814 }
4. $\begin{matrix} 0 & 14 & 3 \end{matrix}$ by 875 }
 $\begin{matrix} 0 & 7 & 1\frac{1}{2} \end{matrix}$ by 1750 }
5. $\begin{matrix} 2 & 5 & 0 \end{matrix}$ by 3540 }
 $\begin{matrix} 1 & 2 & 6 \end{matrix}$ by 7080 }
6. $\begin{matrix} 4 & 3 & 9 \end{matrix}$ by 286578

$\begin{matrix} \text{£.} & \text{s.} & \text{d.} \\ 11 & 7 & 6 \end{matrix}$
66 2 9
623 8 9
7965 0 0
120024 8 9

Application.

1. 9 C.wt. at 1*l*. 11*s*. 5*d*. per C. *Facit* 14*l*. 2*s*. 9*d*.
2. 12 gallons, at 9*s*. 6*d*. per gallon; *5l*. 14*s*. 0*d*.
3. 42 yards, at 4 dol. 60 cents per yard; 193dol. 20cts.
4. 99 yards, at 2 dol. 52 cents per yard; 249dol. 48cts.
5. 144 reams, at 1 dol. 80 cents per ream; 259dol. 20cts.
6. 59 yards, at 1 dol. 3 cents per yard; 67dol. 77cts.
7. 117 C.wt. at 2 dol. 67 cents; 312dol. 39cts.
8. 198 bushels, at 80 cents per bushel; 158dol. 40cts.
9. 275 cords, at 3 dol. per cord; 825dol.
10. 336 yards; at 29 cents, per yard; 97dol. 44cts.
11. 350 ounces, at 11 $\frac{3}{4}$ *d*. per ounce; 17*l*. 2*s*. 8 $\frac{1}{4}$ *d*.
12. 739 tons, at 9 dol. 19 cents per ton; 6791dol. 41cts.
13. Bought a piece of cloth, containing 24 yards, at 1 dol. 83 cents per yard; what comes it to? *Ans.* 43dol. 92cts.
14. What cost a chest of tea, weighing 98lb. at 66 cts. per lb.? *Ans.* 64dol. 68cts.
15. What is the value of 672lbs. of sugar, at 8 cts. per lb.? *Ans.* 53dol. 76cts.
16. If 240 acres of land be let at 1 dol. 74 cents per acre; what is the yearly rent? *Ans.* 417dol. 60cts.
17. If a person expends daily 4 dol. 39 cents, and at the year's end lays up 785 dol. 66 cents, what is his yearly income? *Ans.* 2366dol. 11cts.
18. Sold 1344 lbs. of tobacco, at 20 cents per lb. what is its value? *Ans.* 268dol. 80cts.
19. If a man's income be 90 cents per day, how much is that in a year? *Ans.* 328dol. 50cts.
20. What does a labourer earn in a year, at 30 cents per day, working 6 days in each week? *Ans.* 93dol. 60cts.

COMPOUND DIVISION.

THIS Rule is the reverse of Compound Multiplication, and teaches to divide several numbers of divers denominations; also to find the price of an integer when the quantity and its value are given.

GENERAL RULE.

Divide the first denomination on the left; multiply the remainder (if any) by the numbers of the second denomination.

in an unit of the first, and add the second to the product ; divide the sum as before, &c.

Note. In division of money, call each pound remaining two tens, and if there be ten in the shillings, add one, and continue the process.

PROOF.

By Compound Multiplication.

EXAMPLES.

$$\begin{array}{r} \text{£. s. d.} \\ 2 \overline{)743 \ 17 \ 4} \\ \text{Quotient} \quad 371 \ 18 \ 8 \\ \quad \quad \quad \quad \quad 2 \end{array}$$

$$\begin{array}{r} \text{Proof} \quad 743 \ 17 \ 4 \end{array}$$

$$\begin{array}{r} \text{£. s. d.} \\ 4 \overline{)147 \ 14 \ 8} \end{array}$$

$$\begin{array}{r} \text{£. s. d.} \\ 3 \overline{)9866 \ 19 \ 11\frac{1}{4}} \end{array}$$

$$\begin{array}{r} \text{£. s. d.} \\ 4 \overline{)7685 \ 13 \ 8\frac{3}{4}} \end{array}$$

$$\begin{array}{r} \text{£. s. d.} \\ 5 \overline{)9759 \ 16 \ 7\frac{1}{2}} \end{array}$$

$$\begin{array}{r} \text{lb. oz. dwt. gr.} \\ 5 \overline{)41 \ 11 \ 17 \ 22} \end{array}$$

$$\begin{array}{r} \text{T. C. gr. lb.} \\ 6 \overline{)91 \ 16 \ 2 \ 24} \end{array}$$

$$\begin{array}{r} \text{lb } \frac{3}{4} \ 3 \text{ } \frac{3}{4} \text{ gr.} \\ 7 \overline{)9 \ 10 \ 6 \ 1 \ 18} \end{array}$$

$$\begin{array}{r} \text{Deg. M. fur. P.} \\ 8 \overline{)41 \ 48 \ 7 \ 36} \end{array}$$

$$\begin{array}{r} \text{Yds. ft. in. b.c.} \\ 9 \overline{)18 \ 1 \ 7 \ 2} \end{array}$$

$$\begin{array}{r} \text{Yds. gr. na.} \\ 10 \overline{)67 \ 3 \ 2} \end{array}$$

$$\begin{array}{r} \text{A. R. P.} \\ 11 \overline{)1786 \ 3 \ 33} \end{array}$$

$$\begin{array}{r} \text{T. hhd. G. qt.} \\ 12 \overline{)27 \ 3 \ 24 \ 2} \end{array}$$

$$\begin{array}{r} \text{Bu. P. qt.} \\ 12 \overline{)476 \ 3 \ 6} \end{array}$$

$$\begin{array}{r} \text{Y. m. w. d.} \\ 6 \overline{)1789 \ 11 \ 3 \ 6} \end{array}$$

$$\begin{array}{r} \text{D. h. m. sec.} \\ 7 \overline{)12 \ 5 \ 11 \ 35} \end{array}$$

$$\begin{array}{r} \text{sig. } ^{\circ} \ ' \ '' \\ 8 \overline{)11^{\circ} \ 20' \ 48'' \ 56} \end{array}$$

CASE 1.

When the dividing number does not exceed 12 :

RULE.

Divide the value by said number, the quotient will be the answer.

EXAMPLES.

1. Divide 4s. $6\frac{1}{2}d.$ by 3.

$$\begin{array}{r} s. \quad d. \\ 3 \overline{) 4 \quad 6\frac{1}{2}} \end{array}$$

$$\text{Facit} \quad 1 \quad 6\frac{1}{2}$$

$$\begin{array}{r} s. \quad d. \\ 1 \quad 6\frac{1}{2} \\ 3 \end{array}$$

$$\text{Proof} \quad 4 \quad 6\frac{1}{2}$$

2. Divide $\begin{array}{ccc} \text{£.} & s. & d. \\ 1 & 8 & 4 \end{array}$ by 5
3. $\begin{array}{ccc} & & \\ 3 & 19 & 9\frac{1}{4} \end{array}$ by 7
4. $\begin{array}{ccc} & & \\ 4 & 8 & 6 \end{array}$ by 9
5. $\begin{array}{ccc} & & \\ 3 & 15 & 0 \end{array}$ by 10
6. $\begin{array}{ccc} & & \\ 9 & 17 & 9\frac{1}{4} \end{array}$ by 11
7. $\begin{array}{ccc} & & \\ 11 & 11 & 3 \end{array}$ by $6\frac{1}{2}$
- $\begin{array}{ccc} & & \\ 23 & 2 & 6 \end{array}$ by 12

Facit

$$\begin{array}{r} \text{£.} \quad s. \quad d. \\ 0 \quad 5 \quad 8 \\ 0 \quad 11 \quad 4\frac{1}{4} \\ 0 \quad 9 \quad 10 \\ 0 \quad 7 \quad 6 \\ 0 \quad 17 \quad 11\frac{1}{2} \\ \cdot 1 \quad 18 \quad 6\frac{1}{2} \end{array}$$

Note. Express the parts of a dollar, decimally: fill up the blanks (if any) agreeably to Note 3, Case 1, Compound Multiplication; then divide as taught in Division of Decimals, and value the figures after the point agreeably to Note 2, page 34.

EXAMPLES.

1. Divide 3 dol. 21 cents, by 642. Quot. 5m.
2. 3 dol. 84 cents, by 480. Quot. 8m.
3. 5 dol. 20 cents, 2 mills, by 306. Quot. 1ct. 7m. or 17m
4. 4 dol. 8 cents, by 120. Quot. 3cts. 4m. or 34m.
5. 5 dol. 18 cents, by 74. Quot. 7cts.
6. 7 dol. 84 cents, by 49. Quot. 16cts.
7. 494 dol. 45 cents, by 341. Quot. 1dol. 45cts.
8. 436 dol. 56 cents, by 214. Quot. 2dol. 4cts.
9. 108 dol. 25 cents, 2 mills, by 36. Quot. 3dol. 7m.
10. 673 dol. 62 cents, 5 mills, by 317. Quot. 2dol. 12cts. 5m,

Note. These examples prove those in Case 1. Compound Multiplication.

CASE 2.

When the dividing number is the exact product of some two factors in the Multiplication Table;

RULE.

Divide by one of said factors, and the quotient by the other.

E

EXAMPLES.

1. Divide 173
- l.*
- 14
- s.*
- 7
- d.*
- by 16.

$$\begin{array}{r} \text{£. s. d.} \\ 4 \overline{) 173 \ 14 \ 7} \end{array}$$

$$\begin{array}{r} 4 \overline{) 43 \ 8 \ 7\frac{1}{2}} \end{array}$$

Facit 10 17 1 $\frac{1}{2}$ + 3 rem.

$$\begin{array}{r} \text{£. s. d.} \\ 10 \ 17 \ 1\frac{1}{2} \ 3 \text{ rem} \\ 4 \end{array}$$

$$\begin{array}{r} 43 \ 8 \ 7\frac{1}{2} \\ 4 \end{array}$$

173. 14 7 Proof.

	£.	s.	d.		Facit	£.	s.	d.
2. Divide	3	10	10 $\frac{1}{2}$	by 27	0	2	7 $\frac{1}{2}$	
3.	52	10	0	by 56	0	18	9	
4.	372	16	0	by 96	3	17	8	
5.	225	0	0	by 120	1	17	6	
6.	474	0	0	by 72	6	11	8	
7.	948	0	0	by 144				

Note. Observe the Note in Case 1.

EXAMPLES.

1. Divide 2 dol. 81 cents, 5 mills, by 563. Quot. 5m
2. 30 dol. 27 cents, 2 mills, by 704. Quot. 4 cts. 3m. or 43m
3. 28 dol. 80 cents, by 360. Quot. 8 cts.
4. 100 dol. 88 cents, by 194. Quot. 52 cts.
5. 328 dol. 42 cents, 5 mills, by 75.5. Quot. 4 dol. 35 cts.
6. 385 dol. 2 cents, by 186. Quot. 2 dol. 7 cts.
7. 280 dol. 49 cents, 6 mills by 93.25. Quot. 3 dol. 8m.

Note. These examples prove those in Case 2, Compound Multiplication.

CASE 3.

When the dividing number is not the exact product of any two factors in the table;

RULE.

Divide the greatest denomination by said number, as in Long Division; multiply the remainder (if any) by as many of the next denomination as make one of that, adding in the number of the next name; divide the product as before, &c.

EXAMPLES.

1. Divide 36*l.* 16*s.* 3*d.* by 19.

<i>£.</i>	<i>s.</i>	<i>d.</i>	
19)36	16	3	(1 18 9 Facit
19			$3 \times 6 + 1 = 19$
—			
17		5 16 3	
20		6	
—			
19)356		34 17 6	
19		1 18 9	
—			
166		36 16 3 Proof.	
152			
—			
14			
12			
—			
19)171			
171			
—			

	<i>£.</i>	<i>s.</i>	<i>d.</i>		<i>£.</i>	<i>s.</i>	<i>d.</i>
2. Divide	6	6	8	by 38	Facit	0	3 4
3.	46	17	4	by 74		0	12 8
4.	189	14	0	by 95		1	19 11+
5.	310	12	0½	by 106		2	18 7½
6.	3236	12	4½	by 654		4	18 11½

Note. Observe the Note in Case 1.

1. Divide 6 dol. 42 cents, 0.6mills, by 713.4. Quot. 9m.
2. If 561 lb. of rice cost 42 dolls. 63 cents, 6 mills, how much per lb.? *Ans.* 7cts. 6m.
3. Bought 189.7 yards of riband for 9 dollars, 48 cents, 5 mills, how much per yard? *Ans.* 5cts.
4. Sold 68.75 yards of cloth for 196 dollars, 75 cents, 2.5 mills, how much was it per yard? *Ans.* 2dol. 86cts. 2m.
5. Sold 112.25 yards of broadcloth, for 342 dol. 13 cents, 8 mills, how much was it per yard? *Ans.* 3dol. 4cts. 8m.
6. Bought 378 bushels of wheat, for 380 dollars, 26 cents, 8 mills, how much was it per bushel? *Ans.* 1dol. 6m.

Note. These examples prove those in case 3, Compound Multiplication.*Application.*

1. Bought 4 bushels of salt for 17*s.* 6*d.* what was it per bushel? *Ans.* 4*s.* 4½*d.*

2. Sold 8 yards of linen for 3*l*. 11*s*. 8*d*. what was the price per yard?
Ans. 8*s*. 11½*d*.

3. A labourer had 6 dollars, 72 cents, for 12 days service; what was that by the day?
Ans. 56cts.

4. If 24 yards of cloth cost 43 dollars, 92 cents, the price of one yard is required.
Ans. 1*dol*. 83cts.

5. What is wheat per bushel, when 42 bushels are sold for 49 dollars 14 cents?
Ans. 1*dol*. 17cts.

6. When 100 gallons of wine are sold for 201 dollars, 20 cents, what is a gallon worth?
Ans. 2*dol*. 1ct. 2m.

7. If 58 lbs. of sugar be sold for 2*l*. 5*s*. 11*d*. what is that per lb.
Ans. 9½*d*.

8. Bought 230 bushels of salt for 71 dollars, 30 cents, what was it per bushel?
Ans. 31cts.

9. If 814 lbs. of double refined sugar cost 179 *dol*. 8 cents. what is it by the pound?
Ans. 22cts.

10. If the expense of a public building, amounting to 19116 dollars, be discharged equally by 3540 persons; what is each man's quota?
Ans. 5 *dol*. 40cts.

11. Bought 5 pieces of cloth, each containing 20 yards, for 226 dollars, what was it per yard?
Ans. 2 *dol*. 26cts.

12. Sold 144 bushels of wheat for 152 *dol*. 64 cents, what was the price of 1 bushel at that rate?
Ans. 1*dol*. 6cts.

13. If 400 lbs. of sugar cost 36 dollars, what was it by the lb.
Ans. 9cts.

14. Suppose a man left to 3 sons, viz. to A ¼ of 175 dollars, 40 cents, to B ½ of 150 *dol*. 84 cts. 8 mills, and to C ¾ of 136 *dol*. 64 cents, how much is each man's share, and the whole sum left?

	Dol.	cts.	
<i>Ans.</i> {	43	85	A
	75	42	B
	102	48	C
	221	75	sum left.

REDUCTION.

REDUCTION is the reducing of a given sum or quantity, to a different denomination, retaining the same value.

RULE.

1. When large names are to be brought to less, multiply the greatest denomination by the number of the next less as will make one of the greater, adding in said less denomination, (if any) &c.

2. When small names are to be brought into greater, divide the given denomination by that number which will make one of the next greater, &c. each remainder (if any) will be the same name of the dividend.

PROOF.

Reduce the result of the operation back to its given name.

MONEY.

<i>Far.</i>	<i>Pen.</i>	<i>Shil.</i>	<i>Pound.</i>
4=	1=	$1\frac{1}{2}$ =	$3\frac{1}{4}$
48=	12=	1=	$\frac{1}{4}$
960=	240=	20=	1

EXAMPLES.

1. Reduce 365*l.* to pence.

<i>£.</i>	<i>d.</i>
365	12)87600
20	<hr/>
<hr/>	2|0)730|0
7300	<hr/>
12	Proof 365
<hr/>	<hr/>

Facit 87600

2. Bring 269*l.* 13*s.* 2*d.* into pence. *Ans.* 645998*d.*
3. Reduce 87600 pence to pounds. *Ans.* 365*l.*
4. Reduce 322999 pence to pounds. *Ans.* 1345*l.* 16*s.* 7*d.*
5. In 916*l.* 10*s.* 9*d.* how many qrs.? *Ans.* 879879qrs.
6. In 77*l.* 14*s.* 7*d.* how many half pence?
Ans. 37311 half pence.
7. In 879879 qrs. how many pounds? *Ans.* 916*l.* 10*s.* 9*d.*
8. In 37311 half pence, how many pounds? *Ans.* 77*l.* 14*s.* 7*d.*
9. Reduce 160*l.* 15*s.* 6*d.* into sixpences.
Facit 6431 sixpences.
10. Reduce 194*l.* 10*s.* 8*d.* to groats. *Facit* 11672 groats.
11. Reduce 272*l.* 12*s.* 6*d.* into twopences.
Facit 32715 twopences.
12. In 6431 sixpences, how many pounds? *Ans.* 160*l.* 15*s.* 6*d.*

REDUCTION OF DECIMALS.

CASE 1.

To reduce a Vulgar Fraction to a Decimal:

RULE.

Make a point after the upper number, and annex a sufficient number of cyphers; then divide by the under number.

EXAMPLES.

1. Reduce $\frac{1}{4}$ to a decimal.

$$\begin{array}{r} 4 \overline{) 1.00} \\ \underline{.25} \end{array} \text{ Ans.}$$

2. $\frac{1}{2}$ to a decimal.

Ans. .5

3. $\frac{3}{4}$ to a decimal.

Ans. .75

4. $\frac{1}{11}$ to a decimal.

Ans. .1923+

CASE 2.

To Reduce any sum or quantity to the decimal of a given denomination.

RULE.

1. Divide the given sum, or quantity, in its lowest mentioned denomination, by the proposed integer reduced to the same denomination; the quotient will be the decimal required—Or,

2. Write the given numbers from the least to the greatest in a perpendicular column; then begin with the upper, and divide each of them by such a number as will reduce it to the next greater name, annexing the quotient to the succeeding number; the last quotient will be the decimal required.

Note. In dividing by 20, move the decimal point in the dividend one figure in the left; then divide by 2, rejecting the cypher.

EXAMPLES.

1. Reduce 15s. 8 $\frac{1}{2}$ d. to the decimal of a pound.

$$\begin{array}{r} \text{s.} \quad \text{d.} \\ 15 \quad 8\frac{1}{2} \\ \underline{12} \\ 188 \\ 4 \end{array}$$

$$\begin{array}{l} \text{£.} \quad \text{s.} \quad \text{d.} \quad \text{grs.} \\ \frac{1}{4} = 20 = 240 = 960 \end{array} \begin{array}{l} \text{---} \\ 754.0 \end{array} \begin{array}{l} \text{---} \\ (.7854166 + \text{Ans.}) \end{array}$$

OR,

$$\begin{array}{r} 4 \overline{) 2. \text{ grs.}} \\ 12 \overline{) 8.5 \text{ d.}} \\ 20 \overline{) 1,5708333 \text{ s.}} \end{array}$$

$$\text{£. } .7854166 + \text{Ans.}$$

This method is preferable.

- | | | |
|-----------|--------------------------------------|-----------------------|
| 2. Reduce | 7s. 6d. to the decimal of a pound. | <i>Ans.</i> .375 |
| 3. | 9d. to the decimal of a pound. | <i>Ans.</i> .0375 |
| 4. | 10s. 9½d. to the decimal of a pound. | <i>Ans.</i> .5385416+ |
| 5. | 10s. to the decimal of a pound. | <i>Ans.</i> .5 |
| 6. | 15s. to the decimal of a pound. | <i>Ans.</i> .75 |

CASE 3.

To reduce a decimal fraction to its value;

RULE.

Multiply it by the known parts of an integer, and point the product as in Multiplication.

Note. To find the value of any decimal of a £. by inspection, double the first figure after the point for shillings, adding one, if the second be 5 or more; the second figure, if less than 5, or its excess above 5, call tens; and the third units or farthings, abating one when above 12, and two if above 36.

EXAMPLES.

1. What is the value of .7854166 of a £.?

20	<i>Or by inspection,</i> . <u>7854166</u> l. 15s. 8½d.
s. 15.7083420	
12	
d. 8.4999840	
4	

Ans. 15s. 8d. 1 qr. 1.9999360—Or, 13s. 8½d.

- | | |
|--|--------------------------|
| 2. What is the value of .76 of a £.? | <i>Ans.</i> 15s. 2½d. 6. |
| 3. .625 of a shilling? | <i>Ans.</i> 7½d. |
| 4. .8322916 of a £.? | <i>Ans.</i> 16s. 7½d. |
| 5. .16 of a shilling? | <i>Ans.</i> 1½d. 68+ |
| 6. a tenement, for 9 years, at £.12.4 per annum? | <i>Ans.</i> 111l. 12s. |
| 7. Find the value of .785 of a £. by inspection. | <i>Ans.</i> 15s. 8½d. |
| 8. Find the value of .875 of a £. by inspection. | <i>Ans.</i> 17s. 6d. |

REDUCTION.

FEDERAL MONEY.

<i>Mills.</i>	<i>Cents.</i>	<i>Dimes.</i>	<i>Dol.</i>	<i>Eagles.</i>
10=	1=	$\frac{1}{10}$ =	$\frac{1}{100}$ =	$\frac{1}{1000}$ =
100=	10=	1=	$\frac{1}{10}$ =	$\frac{1}{100}$ =
1000=	100=	10=	1=	$\frac{1}{10}$ =
10000=	1000=	100=	10=	1=

EXAMPLES.

1. How many cents are equivalent to 7 Eagles?

7 Eagles.

10

70 Dollars.

10

Or thus :

700 Dimes.

10

7 Eagles.

1000

1|000)7|000

Ans. 7000 Cents.

7000 Cents. Proof 7 Eagles.

Note. { *Cents*, by deducting one tenth of their number, are reduced to *Pence*.
Pence, by adding one ninth thereof, make *Cents*.

2. Reduce 50 cents, or hundredths of a dollar, to pence, or ninetieths, and these pence back again to cents.

10)50 *Cents*.

5 Subt.

Facit 9)45 *Pence*.

5 Add.

Proof 50 *Cents*.

3. In 85 cents, how many pence?

Ans. 76½d.

4. How many cents are equal 73 pence?

Ans. 81.

5. 742 dollars, how many mills?

Ans. 742000m.

6. Reduce 75460 mills to dollars.

Facit 75 dol. 46 cts.

7. Try how many dollars are in a dozen doubloons,

Facit 179 dol. 19 cts. 6 m.

8. Convert 100 pounds sterling into dollars. Facit 444 dol.

9. Bring 50 French guineas into cents. Facit 13000 cts.

10. In 179 dollars, 19 cents, 6 mills, how many doubloons?
Ans. 12 doubloons
11. In 444 dollars, how many pounds sterling?
Ans. 100*l.* sterling
12. In 86*l.* 15*s.* sterling, how many dollars?
Ans. 385 dol. 17 cts
13. In 385 dollars, 17 cents, how many pounds sterling?
Ans. £. 86.75 = 86*l.* 15*s.*
14. In 45*l.* 10*s.* Irish, how many dollars? *Ans.* 186 dol. 55 cts.
15. In 186 dollars, 55 cents, how many pounds Irish?
Ans. £ 45.5 = 45*l.* 10*s.*

TROY WEIGHT.

Grai.	Pen.	Oun.	Poun.
24 =	1 =	$\frac{1}{16}$ =	$\frac{1}{160}$
480 =	20 =	1 =	$\frac{1}{12}$
5760 =	240 =	12 =	1

EXAMPLES.

1. How many ounces, penny-weights and grains, are in 37 lb.?
Ans. 444 oz. 8880 dwt. 213120 gr.
2. Reduce 213120 grains to pounds. *Facit* 37 lb.
3. In 59 lb. 13 dwt. 5 gr. how many grains? *Ans.* 340157 gr.
4. In four ingots of silver, each weighing 4 lb. 6 oz. 22 dwt. how many grains? *Ans.* 105792 gr.
5. In 9 lb. 7 oz. 10 dwt. of silver, how many spoons, each 5 oz. 10 dwt.? *Ans.* 21 spoons.
6. How many porringers, each to weigh 11 oz. will 19 lb. 3 oz. of silver make? *Ans.* 21 porringers.

DECIMALS.

Note 1. To Reduce one denomination to the decimal of another, observe the Rules in Case 2.

2d. To find the value of a decimal, observe the Rule in Case 3.

EXAMPLES.

1. Reduce 24 grains to the decimal of a lb.

$$\begin{array}{r} 24 \overline{)24} \\ \hline \end{array}$$

$$\begin{array}{r} 20 \overline{)1.00} \\ \hline \end{array}$$

$$\begin{array}{r} 12 \overline{).05} \\ \hline \end{array}$$

.0041666+ *Ans.*

2. Reduce 7 oz. 14 dwt. to the decimal of a lb. *Ans.* .64166+
3. Reduce 17 dwt. 13 gr. to the decimal of an oz. *Ans.* .877+
4. What is the value of .7 lb. ? *Ans.* 8 oz. 8 dwt.
5. of .71 of 4 oz. ? *Ans.* 2 oz. 16 dwt. 19.2 gr.
6. of .85 of a lb. ? *Ans.* 10 oz. 4 dwt.

AVOIRDUPOIS WEIGHT.

<i>Drams.</i>	<i>Ounces.</i>	<i>Pounds.</i>	<i>Qua.</i>	<i>Hun.</i>	<i>Tons.</i>
16=	1=	$\frac{1}{16}$ =	$\frac{1}{4}$ =	$\frac{1}{16}$ =	$\frac{1}{32}$ =
256=	16=	1=	$\frac{1}{2}$ =	$\frac{1}{16}$ =	$\frac{1}{32}$ =
7168=	448=	28=	1=	$\frac{1}{4}$ =	$\frac{1}{8}$ =
28672=	1792=	112=	4=	1=	$\frac{1}{2}$ =
573440=	35840=	2240=	80=	20=	1

EXAMPLES.

1. In 15 tons, how many hundred weight, quarters, and pounds ? *Ans.* 300 cwt. 1200 qr. 33600 lb.
2. Reduce 67200 lb. to tons. *Facit* 30 tons.
3. In 9 C. 5 lb. how many ounces ? *Ans.* 16208 oz.
4. Reduce 20571005 drams to tons. *Facit* 35T. 17C. 1qr. 23lb. 7oz. 13dr.
5. In 6 casks of flour, each 2C. 2qr. 11 lb. how many pounds ? *Ans.* 1746 lb.
6. In 235 parcels of sugar, each 52lb how many hundred weight ? *Ans.* 109C. 12lb.
7. In 17C. 1qr. 6lb. how many parcels, each 34lb. ? *Ans.* 57 parcels.
8. If 12 casks of flour of equal weigh., contain 3492lb. the weight of one cask is required. *Ans.* 2C. 2qr 11lb.

DECIMALS.

Note. Observe the Notes in Troy Weight.

EXAMPLES.

1. Reduce 14 drams to the decimal of a lb

$$16 \overline{) 14.0}$$

$$16 \overline{) .875}$$

$$\underline{\underline{.0546875 \text{ Ans.}}}$$

2. Reduce 4C. 2qr. to the decimal of a ton. *Ans.* 225 ton.
3. What is the value of .861 of an C. wt.?
Ans. 3qrs. 12lb. 6oz. 14.592dr.
4. What is the value of .19 of a ton? *Ans.* 3C. 3q. 5.6lb.
5. Reduce 3C. 2qr. 14lb. to C.wt. *Ans.* 3.625C.wt.
6. Reduce 14lb. to the decimal of a qr. *Ans.* .5qr.
7. What is the value of .225 of a ton? *Ans.* 4C. 2qr.
8. What is the value of .0546875 of a lb.? *Ans.* 14 drams.

APOTHECARIES WEIGHT.

Grai.	Scru.	Dra.	Oz.	Pounds.
20=	1=	$\frac{1}{2}$ =	$\frac{1}{4}$ =	$\frac{1}{16}$
60=	3=	1=	$\frac{1}{2}$ =	$\frac{1}{8}$
480=	24=	8=	1=	$\frac{1}{2}$
5760=	288=	96=	12=	1

EXAMPLES.

1. In 17 lb. how many ounces, drams, and scruples?
Ans. 204 $\frac{3}{4}$, 16323, 43963.
2. In 1332005 grains, how many pounds?
Ans. 231lb, 3 $\frac{3}{4}$, 5gr.
3. In 5 lb. of drugs, how many parcels, each 16 drams?
Ans. 30 parcels.
4. In 20 parcels of drugs, each weighing 24 drams, how many pounds?
Ans. 5lb.

DECIMALS.

Note. Observe the Notes in Troy Weight.

EXAMPLES.

1. Reduce 6 drams, 1 scruple, to the decimal of an oz.

$$\begin{array}{r}
 3 \overline{)1.0} \\
 \underline{3} \\
 8 \overline{)6.3333} \\
 \underline{24} \\
 7916 + \text{Ans.}
 \end{array}$$

2. Reduce 9 oz. 4 dr. to the decimal of a lb. *Ans.* .7916 $\frac{1}{2}$ lb.
3. What is the value of .365 scruples? *Ans.* 7.3gr.
4. What is the value of .436 lb.? *Ans.* 5oz. 1dr. 2sc. 11.3gr.

LONG MEASURE.

Bar. cor.	Inches.	Feet.	Yards.	Poles.	Furlo.	Miles.
3=	1=	$\frac{1}{3}$ =	$\frac{1}{36}$ =	$\frac{1}{180}$ =	$\frac{1}{720}$ =	$\frac{1}{5280}$ =
36=	12=	1=	$\frac{1}{3}$ =	$\frac{1}{24}$ =	$\frac{1}{80}$ =	$\frac{1}{1760}$ =
108=	36=	3=	1=	$\frac{1}{8}$ =	$\frac{1}{32}$ =	$\frac{1}{3520}$ =
594=	198=	16 $\frac{1}{2}$ =	5 $\frac{1}{4}$ =	1=	$\frac{1}{4}$ =	$\frac{1}{1760}$ =
23760=	7920=	660=	220=	40=	1=	$\frac{1}{8}$ =
190080=	63360=	5280=	1760=	320=	8=	1

EXAMPLES.

1. How many inches are in 273 miles? *Ans.* 17297280in.
2. In 34594560 inches, how many miles? *Ans.* 546 miles.
3. Reduce 2 M. 1 fu. 8 po. 3 yds. 2 in. into inches.
Ans. 136334 inches.
4. Reduce 2280060 barley corns to miles.
Ans. 11 M. 7 fur. 38 po. 2 yds. 2 ft.
5. Required the number of revolutions, a wheel 18 ft. 4 in. will make, in running 150 miles. *Facit* 43200.
6. What distance must a measuring wheel, 18 ft. 4 in. in circumference, run to make 86400 turns? *Facit* 300 miles.
7. Required the earth's circumference in yards.
Facit 44035200.

DECIMALS.

Note. Observe the Notes in Troy Weight.

EXAMPLES.

1. Reduce 76 yards to the decimal of a mile.
M. Yards.
 $1=1760$)76.00(.04318. *Ans.*
2. Reduce 25 perches to the decimal of a furlong.
Ans. .625 fur
3. What is the value of .67 of a league?
Ans. 2 m. 3 po. 1 yd. 3 in. 1.8 bc.
4. What is the value of .865 of a mile?
Ans. 6 fur. 36 per. 4.4 yds.

CLOTH MEASURE.

In.	Na.	Qua.	Yd.
2 $\frac{1}{2}$ =	1=	$\frac{1}{4}$ =	$\frac{1}{8}$ =
9=	4=	$\frac{1}{2}$ =	$\frac{1}{4}$ =
36=	16=	4=	1

Reduction.

EXAMPLES.

1. In 15 yds. 3 qr. 1 na. how many nails? *Ans.* 253 na.
2. In 1012 nails of cloth, how many yards? *Ans.* 63 yds. 1 qr.
3. Reduce 73 ells Flemish to quarters. *Facit* 219 qr.
4. How many ells Flemish are in 1752 nails? *Ans.* 146 ells.
5. How many ells English are in 1408 nails? *Ans.* 70 E. 2 qr
6. In 10 bales of cloth, each 10 pieces, and each piece 12 yards, how many yards? *Ans.* 1200 yards.
7. In 408 yds. 3 qrs. of cloth, how many ells Flemish? also, how many ells English? *Ans.* 545 E. Fl. 327 E. E.
8. In 4 bales of cloth, each 12 pieces, and each piece 24 ells English, how many yards and ells Flemish? *Ans.* 1440 yards, 1920 ells Flemish.

DECIMALS.

Note. Observe the Notes in Troy Weight.

EXAMPLES.

1. Reduce 3 qr. 2 na. to the decimal of a yard.

$$\begin{array}{r} 4 \overline{)2.0} \\ \underline{} \end{array}$$

$$\begin{array}{r} 4 \overline{)3.5} \\ \underline{} \end{array}$$

.875 yds.

2. Reduce 7 yds. 2 qr. 3 na. to yards. *Ans.* 7.6875 yds.
3. What is the value of .4712 of an ell English? *Ans.* 2 qr. 1.424 na.
4. What is the value of .6875 of a yard? *Ans.* 2 qr. 3 na.

LAND MEASURE.

Sq. Inch.	Sq. Feet.	Sq. Yd.	Sq. Per.	Rood.	Acre.
144 =	1 =	$\frac{1}{9}$ =	$\frac{1}{16}$ =	$\frac{1}{40}$ =	$\frac{1}{160}$ =
1296 =	9 =	1 =	$\frac{1}{4}$ =	$\frac{1}{10}$ =	$\frac{1}{40}$ =
89204 =	272 $\frac{1}{4}$ =	30 $\frac{1}{4}$ =	1 =	$\frac{1}{5}$ =	$\frac{1}{20}$ =
1568160 =	10890 =	1210 =	40 =	1 =	$\frac{1}{4}$ =
6272640 =	43560 =	4840 =	160 =	4 =	1 =

F

EXAMPLES.

1. Reduce 27 A. 1 R. 32 P. into perches. *Facit 4392 Per.*
2. Reduce 4392 perches into acres. *Facit 27A. 1R. 32P.*
3. Suppose one field to contain 6A. 2R. 36P. another 10A. and a third 12A. 1R. which are to be divided into shares of 76 perches each; query the number. *Ans. 61 shares.*
4. A tract of land, containing 1299600 square perches, is to be divided into 25 plantations; query the number of acres in each. *Ans. 324A. 3R. 24P.*

DECIMALS.

Note. Observe the Notes in Troy Weight.

EXAMPLES.

1. Reduce 4 perches to the decimal of an acre. *Ans. .025 acres.*
2. Reduce 13A. 1R. 14P. to acres. *Ans. 13.3375 ac.*
3. What is the value of .3375 of an acre? *Ans. 1R. 14P.*
4. .092 of 3A. 2R.? *Ans. 1R. 11.52P.*
5. What is the sum of .78A. and .67 of a rood? *Ans. 3R. 31.6P.*

LIQUID MEASURE.

Pints.	Gal.	Tier.	Hhd.	Punch.	P. or B.	Tun.
8 =	1 =	$\frac{1}{4}$ =	$\frac{1}{8}$ =	$\frac{1}{4}$ =	$\frac{1}{16}$ =	$\frac{1}{32}$
336 =	42 =	1 =	$\frac{2}{3}$ =	$\frac{1}{2}$ =	$\frac{1}{4}$ =	$\frac{1}{8}$
504 =	63 =	$1\frac{1}{2}$ =	1 =	$\frac{3}{4}$ =	$\frac{1}{2}$ =	$\frac{1}{4}$
672 =	84 =	2 =	$1\frac{1}{2}$ =	1 =	$\frac{3}{4}$ =	$\frac{1}{2}$
1008 =	126 =	3 =	2 =	$1\frac{1}{2}$ =	1 =	$\frac{1}{2}$
2016 =	252 =	6 =	4 =	3 =	2 =	1

EXAMPLES.

1. In 19 hhd. of wine, how many pints? *Ans. 9576pt.*
2. Reduce 19152 pints to hhd. *Facit 38hhd.*
3. In 11 barrels of beer, how many quarts? *Ans. 1386qt.*
4. How many dozen of gallon, quart, and pint bottles, each a like number, will be required to contain a cask of Madeira, whose content is 165 gallons? *Ans. 10 dozen.*

DECIMALS.

Note. Observe the Notes in Troy Weight.

EXAMPLES.

1. Reduce 1 pint to the decimal of a gallon. *Ans.* .125 gal.
2. Reduce 8 gal. 2 qts. to the decimal of a barrel. *Ans.* .26984 + bar.
3. What is the value of .125 of a gallon? *Ans.* 1 pt.
4. .672 of a barrel? *Ans.* 21 gal. 1.344 pt.

DRY MEASURE.

<i>Pt.</i>	<i>Qt.</i>	<i>Pec.</i>	<i>Bu.</i>
2 =	1 =	$\frac{1}{2}$ =	$\frac{1}{4}$
8 =	4 =	$\frac{1}{4}$ =	$\frac{1}{8}$
16 =	8 =	1 =	$\frac{1}{2}$
64 =	32 =	4 =	1

EXAMPLES.

1. In 17 bushels, 5 quarts, how many pints? *Ans.* 1098 pints.
2. In 5054 pints, how many bushels? *Ans.* 78 bu. 3 pe. 7 qt.
3. In 4 granaries, each containing 65 bu. 1 pe. 6 qt. how many sacks will they fill, each to hold 5 bu. 2 pecks? *Ans.* 47 sacks, 3 bu. 1 pe. over.

DECIMALS.

Note. Observe the Notes in Troy Weight.

1. Reduce 6 quarts, 1 pint, to the decimal of a peck. *Ans.* .8125 pec.
2. Reduce 3 pecks, 4 quarts, to the decimal of a bushel. *Ans.* .875 bu.
3. What is the value of .8125 of a peck? *Ans.* 6 qt. 1 pt.
4. What is the value of .875 of a bushel? *Ans.* 3 pe. 4 qt.

Reduction.

TIME.

<i>Seconds.</i>	<i>minutes.</i>	<i>hours.</i>	<i>days.</i>	<i>weeks.</i>	<i>months.</i>
60 =	1 =	$\frac{1}{24}$ =	$\frac{1}{7}$ =	$\frac{1}{104}$ =	$\frac{1}{12}$ =
3600 =	60 =	1 =	$\frac{1}{7}$ =	$\frac{1}{104}$ =	$\frac{1}{12}$ =
86400 =	1440 =	24 =	1 =	$\frac{1}{4}$ =	$\frac{1}{3}$ =
604800 =	10080 =	168 =	7 =	1 =	$\frac{1}{4}$ =
2419200 =	40320 =	672 =	28 =	4 =	1 =
31557600 =	525960 =	8766 =	365 $\frac{1}{4}$ =	52w. 1d. 6h. =	1yr.

EXAMPLES.

1. Reduce 37w. 5d. into minutes. *Facit* 380160 m.
2. Reduce 24796800 sec. to weeks. *Facit* 41 w.
3. How many hours, minutes and seconds are there in a year?
Ans. 8766h. 525960m. 31557600sec.
4. From the creation of the world, 4004 years before Christ, to the year 1790, inclusive, how many days have passed?
Ans. 2116258d. 12h.

DECIMALS.

Note. Observe the Notes in Troy Weight.

EXAMPLES.

1. Reduce 7 minutes to the decimal of a day.
Ans. .00486 + day.
2. Reduce 3 months, 1 week, 5 days, to months.
Ans. 3.42857 + mo.
3. What is the value of .761 of a day?
Ans. 18h. 15m. 50.4sec.
4. What is the value of .3 of a year? *Ans.* 109d. 13h. 48m.

MOTION.

<i>Seconds.</i>	<i>minutes.</i>	<i>deg.</i>	<i>signs.</i>	<i>revolu.</i>
60 =	1 =	$\frac{1}{360}$ =	$\frac{1}{129600}$ =	$\frac{1}{3153600}$ =
3600 =	60 =	$\frac{1}{60}$ =	$\frac{1}{360}$ =	$\frac{1}{129600}$ =
108000 =	1800 =	30 =	1 =	$\frac{1}{12960}$ =
1296000 =	21600 =	360 =	12 =	1 =

EXAMPLES.

1. In 6 signs of the zodiac, how many minutes?
Ans. 10800 min.
2. How many seconds are there in one complete revolution of any planet?
Ans. 1296000 sec.

THE SINGLE RULE OF THREE.

The Single Rule of Three is that wherein three numbers or terms are given, two of which are of one kind, to find a fourth proportional number of the same kind, with the other given term: and this consists of two proportions, viz. Direct and Inverse.

RULE FOR STATING.

Of the two similar terms, set that in the first place which implies the supposition; that of the same kind with the term sought in the second place, and that on which the demand lies in the third place—Then,

Let the first and third term be not of one denomination, reduce both (if necessary) to the lowest in either, and the second lowest given denomination—Or,

Reduce the first and third to a decimal of the same denomination, and the second to a decimal of the greatest, or a convenient denomination—Then,

Consider whether the proportion be Direct or Inverse.

Note. By annexing aliquot parts decimally, reductions are frequently avoided.

DIRECT PROPORTION.

Direct Proportion is that wherein the third term is greater than the first, and requires the fourth to be greater than the second; or the third less than the first, and requires the fourth to be less than the second—For,

As often as the third term is greater or less than the first, so many times will the fourth be greater or less than the second—Thus,

$$\begin{array}{rclcl}
 \text{Yds.} & \text{s.} & \text{Yds.} & \text{s.} & \\
 \text{If } \left\{ \begin{array}{l} 3 \dots 6 \dots 9 \dots 18 \text{ more requiring more,} \\ 20 \dots 40 \dots 5 \dots 10 \text{ less requiring less.} \end{array} \right. & & & & \\
 & & = 2 & &
 \end{array}$$

RULE.

Multiply the second and third terms together, and divide the product by the first term; the quotient will be the fourth term, or answer, in the same name with the second, or that to which it was reduced.

If there be any remainder, reduce it to the next lower denomination, &c. Or add cyphers for a decimal.

PROOF.

Invert the question, that is, make the fourth term, or answer, the first term; the third term, the second; and the second term, the third; and the result in this operation will be the same of the second in this stating, or of the first in the first stating. Thus the preceding:

$$\begin{array}{rcccl} & s. & yds. & s. & yds. \\ \text{If } \left\{ \begin{array}{l} 18 \dots 9 :: 6 \dots 3 \\ 10 \dots 5 :: 40 \dots 20 \end{array} \right\} & & & & \text{The first term.} \end{array}$$

Note. The operation may be frequently contracted, by dividing the dividing term; and either of the other two, one by the other, or by any number that will divide them both without a remainder, and using their quotients in their stead, cancelling the figures so contracted, as are denoted by this dash — over them, as in the subsequent

EXAMPLE.

If 24 yards cost 60s. how much will 8 yards cost?

$$\begin{array}{rcccl} Yds. & s. & Yds. & & 12) \quad Yds. & s. & Yds. \\ \text{If } 24 : 60 :: 8 & & & & \text{If } 24 : \overline{0} :: \overline{8} \\ \hline & & & & \hline & & & & \overline{2} & \overline{5} & \overline{4} \\ & & & & \hline & & & & & \overline{4} & \hline & & & & & \hline & & & & & & 20s. \text{ Ans.} \end{array}$$

$$\begin{array}{l} \text{That is } 24 \div 8 = 3 \\ \text{And } 60 \div 3 = 20s. \end{array}$$

EXAMPLES.

1. If 3 oz. of silver cost 17s. what is the value of 48 oz.?

$$\begin{array}{r}
 \text{oz.} \quad \text{s.} \quad \text{oz.} \\
 \text{If } 3 \dots 17 :: 48 \\
 \quad \quad \quad 17 \\
 \quad \quad \quad \hline
 \quad \quad \quad 3)816 \\
 \quad \quad \quad \hline
 \quad \quad \quad 2,0)27,2s. \\
 \quad \quad \quad \hline
 \end{array}$$

$$\begin{array}{r}
 \text{s.} \quad \text{oz.} \quad \text{s.} \\
 \text{If } 13 \dots 12 :: 48 :: 17 \\
 \quad \quad \quad 20 \quad \quad 17 \\
 \quad \quad \quad \hline
 \quad \quad \quad 272 \quad \quad)816(3 \text{ oz. Proof.} \\
 \quad \quad \quad \quad \quad \quad 816 \\
 \quad \quad \quad \quad \quad \quad \hline
 \quad \quad \quad \quad \quad \quad \dots \\
 \quad \quad \quad \quad \quad \quad \hline
 \end{array}$$

2. If 8 yards of cloth cost 3 dol. 20 cts. what will 96 yards come to? *Ans.* 38 dol. 40 cts.
3. How many yards of cloth may be bought for 38 dol. 40 cts. when 8 yards cost 3 dol. 20 cts.? *Ans.* 96 yards.
4. If 72 yards of cambric cost 119 dol. 44 cts. how much will 9 yards come to? *Ans.* 14 dol. 93 cts.
5. If 96 lb. of sugar cost 9 dols. 60 cts, how much is it per lb.? *Ans.* 10 cts.
6. What is the value of 1 Cwt. of sugar, at 8 pence per lb.? *Ans.* 3l. 14s. 8d.
7. At 15 pence per lb. what is loaf sugar per Cwt.? *Ans.* 7l.
8. If 1.4 lb. of mace cost 14.5s. what cost 75.31 lb.? *Ans.* 38l. 19s. 11½d. 52
9. If 1.6 Cwt. of sugar sell for 9 dol. 76 cts. how much will 3 hogsheads bring, each weighing 11 C. 3 qr. 10.12 lb.? *Ans.* 216 dol. 67 cts. 8.5 m.
10. Sold 12.5 lhds. of wine at 1.2s. per pint, how much is the amount? *Ans.* 378l.
11. What is the price of a barrel of beer, at 16 pence per gallon? *Ans.* 2l. 2s.
12. If 19 dozen pair of hose cost 136 dol. 80 cts. how much is that per pair? *Ans.* 60 cts.
13. Sold 3 Cwt. of tobacco, at 20 cts. per lb. how much is the amount? *Ans.* 67 dol. 20 cts.

14. If 1 Cwt. of iron cost 3 dol. 72 cts. what is the value of 33 C. 1 qr. 22 lb. ? *Ans.* 124 dol. 42 + cts.

15. Bought 12 pieces of cloth, each 12 yards, at 1 dol. 40 cts. per yard, how much do they come to ? *Ans.* 201 dol. 60 cts.

16. Bought three pieces of cloth, each 21.5 yards, at 1 dol. 64 cts. how much do they cost ? *Ans.* 105 dol. 78 cts.

17. If 8.4 lb. of tobacco cost 2 dol. 19 cts. what is the value of three hhds, each 4 C. 2 qr. 7.4 lb. ? *Ans.* 399 dol. 98 cts. 6.6m.

18. How many yards are in a piece of cloth which brings 17 dol. 75 cts. at 56.25 cts. per yard ? *Ans.* 31.5555 yds.

19. If 36 oz. 10 dwt. of silver be worth 24 dol. 35 cts. how much is that per ounce ? *Ans.* 66 cts. 6 + m.

20. When a bankrupt compounds with his creditors, at 12s. 6d. in the £. how much is the merchant's quota to whom he owes 1000l. ? *Ans.* 625l.

21. How much is tobacco an ounce, when 17 C. 3 qr. 17 lb. sells for 320 dol. 80 cts. ? *Ans.* 1 ct.

22. What quantity of sugar will 62 dol. 67 cts. buy, at 3 dol. 55 cts. per Cwt. ? *Ans.* 17 C. 2 qr. 17 lb.

23. What do 518 lb. of tea come to, if 90 lb. cost 47 dol. 70 cts. and how much is it per lb. ? *Ans.* 274 dol. 54 cts. at 53 cts. per lb.

24. Bought 5.8 tons of oil for 169 dol. 32 cts. whereof 50.6 gallons leaked out; how much must the remainder be sold at per gallon, that the purchaser may be no loser ? *Ans.* 12 cts.

25. A grocer bought 7.6 Cwt. of sugar at five cents per lb, how much does it come to ? *Ans.* 42 dol. 56 cts.

26. Bought 3 C. 1.5 qr. of cloves at 38 cts. per lb. how much come they to ? *Ans.* 143 dol. 64 cts.

27. Sold 436.7 yards of cloth at 1 dol. 14 cts. per yard, how much come they to ? *Ans.* 497 dol. 83 cts. 8 m.

28. If 17 T. 12 Cwt. of iron cost 440 dol. how much for 2 Cwt. ? *Ans.* 2 dol. 50 cts.

29. If a man's daily income be 2 dol. 25 cts, how much will it amount to in a year ? *Ans.* 821 dol. 25 cts.

30. Bought 14 bags of hops, each containing 546 lb. for 43 English guineas sterling; how many dollars will pay for 1 Cwt. ? *Ans.* 3 dol. 28 cts. 2 m.

31. What sum will pay for three casks of brandy, containing 58, 62, and 65.5 gallons, at 6s. 8d. per gallon ? *Ans.* £11. 16s. 8d.

32. What will 4 pieces of cloth come to, containing 23, 24, 25, and 27 yards, at 5s. 5d. per yard ? *Ans.* 26l. 16s. 3d.

33. Bought 4 pieces of linen, two of which contain 26.5 yards each, and each of the other two, 23.75 yards, what did they come to, at 35 cts. per yard? *Ans.* 35 dol. 17 cts. 5 m.

34. Suppose A owes B 791 dol. 60 cts. and can pay but 37 cts. 5 mills per dollar, how much must B receive? *Ans.* 296 dol. 85 cts.

35. How many English ells of Holland may be bought for 64 dols. 28 cts. 3 mills, at 1 dol. 3 cts. 5 m. per yard? *Ans.* 49 E. 3 qr. 1.9 na.

36. If a yard of ribbon sell for 4 cts. 5 mills, how many dollars will buy 345.6 yards? *Ans.* 15 dol. 55 cts. 2m.

37. When 675 yards cost 12.825 dollars, how many yards may be had for 38 mills? *Facit* 2 yards.

38. If nineteen yards of calico bring 25.75 dollars; how much will 435.5 yards come to? *Facit* 590 dol. 21 cts. 7 m. +

39. How much must be paid for 53 ells English, 1 qr. of Holland, at 1 dol. 4 cts. per yard? *Facit* 69 dol. 16 cts.

40. A draper bought 242 yards of broad-cloth for 678 dol. 66 cts. 7 m. for 86 yards of which, he gave 2 dol. 84 cts. 4 m. per yard, what was the price of the remainder per yard? *Facit* 2 dol. 78 cts. 2 m.

41. At 6 dol. 38 cts. per acre, what is the annual rent of 173A. 2R. 14P. *Facit* 638 dol. 75 cts. 2 m.

42. What quantity of sugar may be bought for 70 dol. 75 cts. when the price of 43.5 Cwt. is 424 dols. 50 cts.? *Facit* 7C. 1 qr.

43. A person failing in trade, owes 977l. and the inventory of his effects amounts but to 420l. 6s. 3½d. how much will this produce per £. to his creditors? *Facit* 8s. 7½d.

44. What must be given for a piece of silver weighing 73 lb. 5.75 oz. at 77 cents per oz? *Facit* 678 dol. 94 cts. 7.5 m.

45. Bought 3 casks of raisins, each weighing 3C. 1.25 qr. how much will they cost, at 6 dol. 19 cts. per Cwt? *Facit* 61 dol. 51 cts. 3.125 m.

46. What will the tax upon 1786 dol. 67 cts. be, at the rate of 12 cts. per dol.? *Facit* 214 dol. 40 cts. 0.4 m.

47. How much will 1.25 qr. of velvet cost at 2 dol. 47 cts. per yard? *Facit* 77 cts. 1.875 m.

48. A bankrupt compounds with his creditors, for 8s. 7½d. in the pound, and at that rate pays 420l. 6s. 3½d. how much did he owe? *Facit* 977l.

49. What is the value of a silver tankard, weighing 1 lb. 7 oz. 14 dwt. at 6s. 4d. per oz? *Facit* 6l. 4s. 9d. +

50. What must be paid for 7 casks of prunes, each weighing 2.375 Cwt. at 7 dol. 95 cts. 4 m. per Cwt? *Facit* 132 dol. 23 cts. 5.25 m.

51. If 5 yards of cloth cost 14s. 2d. what must be given for 9 pieces, each containing 21.25 yards? *Facit* 27*l.* 1*s.* 10½*d.*

52. If a person's estate be worth 3858 dol. 24 cts. a year, out of which he saves 1200 dol. how much per day will the remainder be? *Ans.* 7 dol. 28 cts. 2.8 m.

53. If a man's annual income be 1833 dol. and he expends daily 2 dol. 14 cts. how much will he save at the year's end?

Facit 551 dol. 90 cts.

54. If a staff four feet long, cast a shade (on level ground) 7 feet long, what is the height of a steeple, whose shade at the same time is 198 feet? *Facit* 113½ feet.

55. The earth being 360 degrees in circumference, turns round on its axis in 24 hours, how far are the inhabitants on the equator, carried in one minute; a degree there being 69.5 miles? *Facit* 17 m. 3 fur.

56. A merchant would lay out in spices 1498 dol. viz. cloves at 53 cts. per lb. mace at 94 cts. cinnamon at 40 cts. and nutmegs at 27 cts. and he would have an equal quantity of each sort; what must that quantity be? *Facit* 700 lb. of each sort.

57. A goldsmith bought of a merchant 14 lb. 3 oz. 8 dwt. of gold, for 1371 dol. 20 cts. how much per oz? *Facit* 8 dol.

58. How many reams of paper, at 1 dol. 66 cts. 1 dol. 97 cts. and 2 dol. 31 cts. per ream, and of each an equal number, may be purchased with 528 dol. 66 cts.? *Facit* 89 reams of each sort.

59. If 9.75 Cwt. of sugar cost 82 dol. 75 cts. how much will 2 Cwt. cost? *Ans.* 16 dol. 97 cts. 4.3 m.

60. Sold 59 C. 1 qr. 14 lb. of sugar, at 3 dol. 67 cts. per Cwt. what is the amount? *Facit* 217 dol. 90 cts. 6.25 m.

61. Bought 476A. 3R. 2.8P. of land, at 9 dollars per acre; the value thereof is required? *Facit* 4290 dol. 90 cts. 7.5 m.

INVERSE PROPORTION.

Inverse Proportion is that in which the third term is greater than the first, and requires the fourth to be less than the second: or the third less than the first, and requires the fourth to be greater than the second; for, as often as the third term is greater or less than the first, so many times will the fourth be respectively less or greater than the second. Thus:

{	men.	days.	men.	days.	More requiring less.
	4 . .	6 . .	8 . .	3	
{	In. wide.	In. long.	In. wide.	In. long.	Less requiring more.
	12 . .	12 . .	3 . .	48	

RULE.

Multiply the first and second terms together, and divide the product by the third term; the quotient will be the fourth term, or answer, as in direct Proportion.

PROOF;

As in Direct Proportion. Thus :

If $\left\{ \begin{array}{l} \text{days.} \quad \text{men.} \quad \text{days.} \quad \text{men.} \\ 3 \quad \dots \quad 8 \quad :: \quad 6 \quad \dots \quad 4 \end{array} \right.$

$\left\{ \begin{array}{l} \text{In. long.} \quad \text{In. wide.} \quad \text{In. long.} \quad \text{In. wide.} \\ 48 \quad \dots \quad 3 \quad :: \quad 12 \quad \dots \quad 12 = 1 \text{ foot sqr.} \end{array} \right.$

Note. See the last Note.

EXAMPLES.

1. If 48 men can build a wall in 24 days; how many men can do the same in 192 days?

d. m. d.
If 24 .. 48 :: 192 ..
24

192)1152(6 men Ans.

Contracted.

d. m. d.
If $\overline{24} \dots \overline{48} :: \overline{192}$

men. 6 Ans. $\overline{24}$

2. What quantity of shalloon, that is .75 yards wide, will line 7.5 yards of cloth, that is 1.5 yards wide? Ans. 15 yds.

3. If 100 men can finish a piece of work in 12 days, how many can do it in three days? Ans. 400 men.

4. If 12 inches long, and 12 wide, make 1 foot square, how much in length, that is $4\frac{1}{2}$ inches broad, will make a foot square? Ans. 32 inches.

5. How many yards of matting, 2 feet 6 inches broad, will cover a floor 27 feet long, and 20 wide? Ans. 72 yards.

6. How many yards of cloth, 3 qrs. wide, are equal in measure to 30 yards, 1.25 yards wide? Ans. 50 yards.

7. If a board be 9 inches broad, what length will it require to measure 12 square feet? Ans. 16 feet.

8. If 100 dollars principal, in 12 months, gain 6 dollars interest, what principal will gain the same in 8 months? Ans. 150 dollars.

9. How many yards of paper, $1\frac{1}{4}$ yards wide, will be sufficient to hang a room the walls of which are 20 yards long and 4 yards high? Ans. 64 yards.

10. How many men must be employed to finish a piece of work in 15 days, which 5 men can do in 24 days? *Ans.* 8 m.

11. If when flour is 6 dollars per Cwt. the cent-cake weighs 1.1938 oz. what should be the weight of it when flour is only 1.8125 dol. per Cwt. ? *Ans.* 3 oz. 12 dr.

12. If a footman performs a journey in three days, when the days are 16 hours long, how many days will he require of 12 hours long to perform the same in? *Ans.* 4 days.

13. If 6 men can reap a field of wheat in 12 days, in what time will 24 m:n do it? *Ans.* 3 days.

14. In how many days will 8 men finish a piece of work which 5 men can do in 24 days? *Ans.* 15 days.

15. If 160 poles long, and 1 pole wide, make an acre, how much in length, that is 8 poles wide, must be taken to contain an acre? *Ans.* 20 poles.

16. A lent B 500 dollars for 6 months; how long ought B to lend A 220 dollars to be equivalent? *Ans.* 13 m. 19 days.

17. If when wheat is 60 cents per bushel, the cent-loaf weighs 12 oz. what must the cent-loaf weigh, when wheat is but 40 cents per bushel? *Ans.* 18 oz.

18. What is the weight of a pea to a steelyard, which being suspended 39 inches from the centre of motion, will equipoise 208lb. suspended at the draught end .75 inches? *Ans.* 4 lb.

19. Suppose 800 persons in a garrison, with provisions sufficient for 2 months; how many must depart, that the provisions may serve the remainder 5 months? *Ans.* 480.

20. How many yards of matting, that is 1.5 feet wide, will cover a room that is 18 feet wide, and 30 long? *Ans.* 120 yds.

21. How wide must a lot of ground be, to contain an acre, when it is 13.5 poles long? *Ans.* 11p. 4yd. 2ft. 0in. 2b.c.

22. If, when wheat is 83 cents per bushel, the cent-loaf weighs 9 oz. what ought it to weigh, when wheat is at 1 dol. 24 cents, 5 mills per bushel? *Ans.* 6 oz.

23. In what time will 600 dollars gain 50 dollars interest, when 80 dollars gain it in 15 years? *Ans.* 2 years.

24. How much Persian, .75 yards wide, will line 25.5 yards of 5 quarters wide? *Ans.* 42.5 yards.

Application.

1. If 3 quarters of a yard of velvet cost 99 cents, how many yards can I buy for 37 dol. 62 cts. ? *Ans.* 28 yds. 2 qr.

2. If an ingot of gold, weighing 9 lb. 9 oz. 12 dwt. be worth 1128 dol. 96 cents, what is it per grain? *Ans.* 2 cts.

3. A borrowed of B 250 dol. for 7 months, and in return lends him 300 dol.; how long ought B to keep it, that the interest of it may be equal to that of the first sum?

Ans. 5m. 25d.

4. If a person's income be 500 English guineas a year, and he spends 2dol. 60cts. per day, how much will he save at the year's end?

Ans. 1384.5dol.

5. At 1.76dol. per yard, what is the value of a piece of cloth containing 52 English ells, and 3qrs.?

Ans. 115dol. 72cts.

6. If 30 men can perform a piece of work in 11 days, how many men will accomplish another piece of work four times as large in 12 days?

Ans. 110 men.

7. If 87 dol. 50 cts. be assessed on 1750 dollars, how much is it per dollar?

Ans. 5cts.

8. Bought 3 tuns of oil for 409.31 dollars, and 85 gallons of which being lost, how much per gallon must the remainder be sold for, so as to sustain no loss?

Ans. 61cts.

9. If the carriage of 5.125 Cwt. 96 miles, be 32s. 6d. how far may 3.25 Cwt. be carried for the same money?

Ans. 151m. 3fur. 3p.

10. Bought 200 yards of cambric for 90l. which being damaged, am willing to lose 7l. 10s. by the whole; at how much then must it sell per ell English?

Ans. 10s. 3½d.

11. If for 684 dol. 225 Cwt. be carried 512 miles, how many Cwt. may be carried 64 miles for the same money?

Ans. 1860Cwt.

12. A certain steeple projected upon level ground, casts a shadow to the distance of 683 feet 4 inches, when a staff 3 feet in length perpendicularly erected, casts a shadow of 6 feet 4 inches; from hence the height of the steeple is required.

Ans. 100yds.

13. If 12 yards of yard wide stuff, exactly line 8 yards of silk of another breadth; how many yards of the latter will line 24 pieces of the former, each piece containing 20 yards?

Ans. 320yds.

14. Laid out 240 dol. in serges and shalloons; the value of the shalloons was 144 dol. and the quantity of serge 237 yds. and for every two yards of serge, there were three of shalloon; how many yards of shalloon were there, and what was the value of one yard of each sort?

Ans. 355½ yards shall. 40 cts. 5m. +

15. How many pieces of Holland, each 33 ells Flemish, 1 qr. 2 na. may be had for 432 dol. when 4 ells English cost 3.75 dollars?

Ans. 22 pieces, 31 ells.

16. The French foot is just 1.068 ft. English; how tall then will a six feet Philadelphian be at Paris? *Ans.* 5.618 ft.

17. If a pole perpendicular to the horizon, of 50 ft. 11 in. in length, when the sun is on the meridian, casts a shadow 98 ft. 6 in. long, what is the breadth of a river, running due east and west within 20 feet 6 inches on the north side of a steeple 300 ft. 8 in. high, which at the same time casts the extremity of its shadow 30 ft. 9 in. beyond the stream?

Ans. 176 yards, 2 ft. 4 in.

18. If 20 feet long and 1 wide, make 20 square feet, how much in length that is 7.5 inches wide, will make the same?

Ans. 32 ft.

19. A and B depart from the same place, and go the same road; but A goes five days before B, at the rate of 20 miles a day; B follows at the rate of 25 miles a day; in what time, and at what distance will he overtake A?

Ans. 20 d. and 500 m.

20. If 50 gallons of water in one hour, fall into a cistern containing 230 gallons, and by a pipe vents 35 gallons in one hour, in what time will it be filled?

Ans. 15h. 20m.

THE DOUBLE RULE OF THREE.

The Double Rule of Three is that, wherein five numbers or terms are given to find a sixth, three of which are a supposition, and two a demand; and is either Direct or Inverse.

RULE FOR STATING.

Set the two terms of the supposition, which are like those of the demand, one under the other, in the first place; that of the same kind with the term sought, in the second; and the two demanding terms in the third place, with the two correspondent terms of the supposition and demand in the same line, and of one denomination, as in the subsequent

EXAMPLES.

1. If 3 men in four days eat 5 lb. of bread, how much will suffice six men for 12 days?

If 3 m. }	5 lb.	{ 6 m.
4 d. }		{ 12 d.

2. If 3 men eat 5lb. in four days, in how many days will 6 men consume 30lb.?

$$\begin{array}{l} \text{If 3 m. } \} \\ \text{5 lb. } \} \end{array} \quad \begin{array}{l} 4 \text{ d.} \\ \end{array} \quad \begin{array}{l} \} 6 \text{ m.} \\ \} 30 \text{ lb.} \end{array}$$

To know whether the stating be direct or inverse; consider the upper pair of extremes, and the lower, each separately with the middle term, as a stating of the single rule, and try them as taught in that rule; if both lines be direct, the stating is in direct proportion; but of inverse, if either pair of the extremes be so.— Thus, the first example above, is Direct, and the second Inverse.

DIRECT PROPORTION.

RULE.

Divide the continual product of the two last extremes and middle term, by that of the two first, and the quotient will be the sixth term or answer.

PROOF.

By two statings of the single rule of three—Or, invert the stating.

Note. If either of the two first terms, or both will divide, or can be divided by any of the three last, or by any other number, without remainder, the operation may be abbreviated, by cancelling them, and using their quotients or aliquot parts in their stead.

EXAMPLES.

1. If 3 men in 4 days eat 5lb. of bread, how much will suffice 6 men for 12 days?

$$\begin{array}{l} \text{If 3 m. } \} \\ \text{4 d. } \} \end{array} \quad \begin{array}{l} 5 \text{ lb.} \\ \end{array} \quad \begin{array}{l} \} 6 \text{ m.} \\ \} 12 \text{ d.} \end{array}$$

12

72

5

12)360

Answer 30 lb.

Contracted.

$$\left. \begin{array}{l} 1\bar{3} \text{ m. } \} \\ 4 \text{ d. } \} \end{array} \right\}$$

5 lb *

$$\left\{ \begin{array}{l} \bar{6} \text{ m. } (2 \\ 12 \text{ d. } (3 \end{array} \right.$$

6

5

30 lb.

2. Suppose 4 men in 12 days mow 48 acres; how many acres can 8 men mow in 16 days? *Ans.* 128 acres.

3. If 12 oxen in 16 days eat 20 acres of grass; how many acres will serve 24 oxen 48 days? *Ans.* 120 acres.

4. If 10 bushels of oats be sufficient for 18 horses 20 days, how many bushels will serve sixty horses 36 days, at that rate? *Ans.* 60 bushels.

5. If 56 lb. of bread be sufficient for 7 men 14 days, how many pounds will suffice 21 men 3 days? *Ans.* 86 lb.

6. If 8 men have 7 dol. 68 cts. for four days work, how much ought 48 men to receive for 16 days? *Ans.* 184 dol. 32 cts.

7. If 1680 dol. in half a year raise 33 dol. 60 cts. interest; what will be the interest of 960 dollars for 5 years? *Ans.* 192 dol.

8. If 112 acres of grass be mowed by 16 men in 7 days; how many acres may 24 men mow in 19 days? *Ans.* 456 acres.

9. If 40 dol. 56 cts. be the wages of 16 men for 8 days; what sum will 32 men earn in 24 days? *Ans.* 243 dol. 36 cts.

10. If 180 dol. in 9 months amount to 188 dol. 10 cts. at what rate per cent. is the interest computed? *Ans.* 6 dol. per cent.

11. Suppose the wages of 6 persons for 21 weeks be 288 dol. what will be the hire of 14 persons for 46 weeks? *Ans.* 1472 dols.

12. What is the interest of 259l. 13s. 5d. for 20 weeks, at 5 per cent.? *Ans.* 4l. 19s. 10½d.

13. If 2 men can do 12 rods of ditching in 6 days; how many rods may be done by 8 men in 24 days? *Ans.* 192 rods.

14. If the carriage of 8 Cwt. 128 miles, cost 48 shillings; what must be paid for the carriage of 4 Cwt. 32 miles? *Ans.* 6s.

15. If 200 lb. be carried 40 miles for 40 cents; how much must be paid at that rate, for the carriage of 20200 lb. 60 miles? *Ans.* 60 dol. 60 cts.

16. If the freight of 9 hogsheads of sugar, each weighing 12 hundred weight, for 20 leagues, cost 38 dol. 40 cts. what must be paid for the freight of 50 casks of do. each weighing 2½ hundred weight, 100 leagues? *Ans.* 222 dol. 22 cents.

INVERSE PROPORTION.

RULE.

Transpose the inverse extremes, that is, set that of the first place under that of the third, and that in the third under the first; then work as in Direct Proportion.

Note. See the Note in Direct Proportion.

EXAMPLES.

1. If 7 men can reap 84 acres of wheat in 12 days; how many men can reap 100 acres in 5 days?

$$\begin{array}{rcl} \text{If } 84 \text{ A.} & \} & 7 \text{ m.} \\ \underline{12 \text{ d.}} & & \{ 100 \text{ A.} \\ 5 & & \{ 5 \text{ d. Inverse term.} \\ & & \underline{12} \\ & & 1200 \\ & & \underline{7} \end{array}$$

$$\begin{array}{r} 42 \overline{)0840} \overline{)0} (20 \text{ m. Ans.} \\ \underline{84} \end{array}$$

Contracted.

$$\begin{array}{rcl} \text{If } 84 \text{ A.} & \} & 7 \text{ m.} \\ \underline{12 \text{ d.}} & & \{ 100 \text{ A. (20 men.} \\ 5 & & \{ 5 \text{ d.} \\ & & \underline{12} \end{array}$$

2. If 4 dol. be the hire of 8 men for three days; how many days must 20 men work for 40 dollars? *Ans.* 12 days.

3. If 4 men have 3 dol. 20 cts. for 3 days work, how many men will earn 12 dol. 80 cts. in 16 days? *Ans.* 3 men.

4. Suppose the interest of 333*l.* 6*s.* 8*d.* for 9 months, be 15*l.* what principal in 12 months will gain 6*l.*? *Ans.* 100*l.*

5. If 200 lb. be carried 40 miles for 40 cts. how far may 20200 lb. be carried for 60 dol. 69 cts.? *Ans.* 60 miles.

6. If 145 men can make a wall 32 feet high, and 40 feet long, in 8 days; in how many days can 68 men build a wall 28 feet high of the same length? *Ans.* 14 days, 22 hours +

7. If a footman, when the days are 14 hours long, can travel 276 miles, in 16 days; in how many days can he travel 852 miles, when the days are 12 hours long?

Ans. 57 days, 14 hours +

8. If 15 men eat 36 cents worth of bread in 6 days, when wheat is sold at 1 dol. 8 cts. per bushel; how many days will 30 men require to eat 1 dol. 60 cts. worth, when wheat is at 72 cts. per bushel?

Ans. 20 days.

9. If 240 dol. principal, in 12 months, gain 19 dol. 20 cents interest; what principal will gain 20 dol. 64 cents in 5 months?

Ans. 619 dol. 20 cts.

10. Suppose 240 dol. will defray the expenses of 5 men for 22 weeks and six days; how long will 12 men be spending 360 dollars?

Ans. 14 weeks, 2 days.

Application.

1. If 7 bushels of malt be sufficient for 7 persons 4 months; how many bushels will serve 46 persons 10 months?

Ans. 115 bushels.

2. How many men must be employed to reap 240 acres in 12 days, if 36 men can reap 60 acres in 5 days?

Ans. 60 men.

3. If 5 men make 300 pair of shoes in 40 days; how many men may make 900 pair in 60 days?

Ans. 10 men.

4. A porter having received 42 shillings for the carriage of 3 Cwt. 150 miles; how much ought he to have for the conveyance of 7 Cwt. 2 qr. 14 lb. 50 miles?

Ans. 35s. 7d.

5. A person having engaged to remove 8000 Cwt. a certain distance in 9 days; with 18 horses in 6 days he removed 4500 Cwt. how many horses will be required to remove the remainder, in the remaining three days?

Ans. 28 horses.

6. If 20 hundred weight be carried 50 miles for 12 dol. how much will 40 hundred weight cost, to be conveyed 100 miles?

Ans. 48 dol.

7. A farmer having sown 48 bushels, found that it produced 576 bushels the first year; now, suppose he sows 240 bushels of grain each year for six years successively, what will be his whole increase at the expiration of the last year?

Ans. 17280 bushels.

8. If 12 men in 6 days reap 80 acres; in how many days will 25 men reap 200 acres?

Ans. 7½ days.

9. An usurer put out 240 dol. to receive interest for the same; and when it had continued 8 months, he received for principal and interest 248 dol. query the rate per cent?

Ans. 5 per cent.

10. When 12 oxen graze 16.25 acres, in 20 days; how much of like pasture would serve 24 such cattle 100 days?

Ans. 162.5 acres.

11. If 3 men receive 8 dol. 90 cts. for 19.5 days labour; how much must 20 men have for 100.25 days?

Ans. 305 dol. 3 cts. +

12. If 100 dol. in one year gain $3\frac{1}{2}$ dol. interest; what sum will gain 38 dol. 50 cts. in one year and a quarter?

Ans. 880 dol.

13. How many men should reap 417.6 acres in 12 days, when 5 men cut down 52.2 acres in 6 days?

Ans. 20 men.

14. Suppose the interest of 76 dol. 94 cts. for 9.5 months, to be 15 dol. 25 cents; what sum will gain 6 dol. in 12.75 months?

Ans. 22 dol. 55 cts. +

15. A cellar 22.5 feet long, 17.8 wide, and 10.25 deep, being dug in $2\frac{1}{4}$ days by 6 men, working 12.3 hours in a day; how many days of 8.2 hours, should 9 men take to excavate one which measures 45 feet long, 34.6 wide, and 12.3 feet deep?

Ans. 12 days.

PRACTICE.

PRACTICE is a short method of finding the value of any quantity of goods, by the given price of an integer.

Note. See the rules in several cases under this head.

PROOF.

Practice may be proved by varying the parts; by Compound Multiplication; or, by the Single Rule of Three Direct.

TABLES.

gr.		s. d.		lb.	
1 = $\frac{1}{4}$	} of d.	1 0 = $\frac{1}{20}$	} of a pound.	7 = $\frac{1}{14}$	} of an C. wt.
2 = $\frac{1}{2}$		1 8 = $\frac{1}{12}$		8 = $\frac{1}{8}$	
d.		2 0 = $\frac{1}{10}$		14 = $\frac{1}{7}$	
1 = $\frac{1}{4}$	} of a shilling.	2 6 = $\frac{1}{8}$		16 = $\frac{1}{6}$	
1 $\frac{1}{2}$		3 4 = $\frac{1}{6}$		28 = $\frac{1}{5}$	
2 = $\frac{1}{2}$		4 0 = $\frac{1}{5}$		56 = $\frac{1}{2}$	
3 = $\frac{3}{4}$		5 0 = $\frac{1}{4}$			
4 = $\frac{1}{3}$		6 8 = $\frac{1}{3}$			
6 = $\frac{1}{2}$		10 0 = 1			

CASE 1.

When the price of an integer is less than a penny;

RULE.

Take such aliquot part or parts of the given quantity as the price is of a penny, for the answer in pence; which reduce to pounds.

Note 1. When the complement of the given price, in any case, is an aliquot part, deduct the said aliquot part of the given quantity therefrom; and the remainder will be the answer of the same denomination with the integer, of which the divisor is a part.

2d. When a remainder occurs in any example, either in this or the following cases, let it be reduced to the next lower denomination, &c.

EXAMPLES.

1. 7612 lb. at $\frac{1}{4}$ per lb. and at $\frac{3}{4}$.

$\frac{1}{4}$	$\frac{1}{4}$	7 6 1 2
	12	1 9 0 3
	2|0	1 5|8 7

Facit £. 7 18 7

7 6 1 2
1 9 0 3
12)5 7 0 9
2|0) 47|5 9
£. 23 15 9

2. 6812 at $\frac{1}{2}$

3. 4712 at $\frac{3}{4}$

4. 15344 at $\frac{1}{2}$ }

5. 7672 at $\frac{1}{2}$ }

6. 9424 at $\frac{3}{4}$

Facit	£.	s.	d.
	14	3	10
	14	14	6
	15	19	8
	29	9	0

Note. When the price of an integer is less than one cent—

Take the aliquot part or parts of a cent, for the answer in cents—or multiply as in Case 1, Compound Multiplication.

EXAMPLES.

1. 642 at 5 mills each;

Ans. 3 dol. 21 cts.

2. 480 at 8 mills each;

Ans. 3 dol. 84 cts.

3. 342 at 7 mills each;

Ans. 2 dol. 39 cts. 4 m.

4. 796 at 9 mills each;

Ans. 7 dol. 16 cts. 4 m.

Note. The two first examples are taken from Case 1, Compound Multiplication.

CASE 2.

When the given price of an integer is a penny, or more, but less than a shilling;

RULE.

Take such part or parts of the given quantity, as the price is of a shilling, for the answer in shillings.

EXAMPLES.

1. 7612 yards at 1*d.* per yard and at 11*d.*

$$\begin{array}{r|l} 1 & \frac{1}{12} \\ \hline & 2|0 \end{array} \quad \begin{array}{r} 7 \ 6 \ 1 \ 2 \\ \hline 6 \ 3 \ 4 \end{array} \quad \begin{array}{r} 4 \\ 4 \end{array}$$

Facit £. 31 14 4

$$\begin{array}{r} 7 \ 6 \ 1 \ 2 \\ \frac{1}{12} = 6 \ 3 \ 4 \end{array} \quad \begin{array}{r} 4 \\ 4 \end{array}$$

$$2|0)6 \ 9 \ 7|7 \quad 8$$

£. 348 17 8

		<i>d.</i>			<i>£.</i>	<i>s.</i>	<i>d.</i>
2.	8612 at	1½	Facit	44	17	1	
3.	1218 at	2½		12	13	9	
4.	7812 at	3½		122	1	3	
5.	8120 at	4		135	6	8	
6.	8121 at	5½		177	12	11½	
7.	1218 at	6½		32	19	9	
8.	6120 at	7½		197	12	6	
9.	7100 at	8		236	13	4	
10.	4121 at	9½		158	16	7½	
11.	1002 at	10½		48	16	9	
12.	2345 at	11½		114	16	1½	
13.	6002 at	4½		112	10	9	
14.	3001 at	9					
15.	7182 at	5					
16.	3591 at	10		149	12	6	
17.	6128 at	5½					
18.	3064 at	11		140	8	8	

Note. When the price of an integer is one cent, or more, but less than ten cents—Take the aliquot part or parts of a dime, for the answer in dimes—Or, multiply as in Case 1, Compound Multiplication.

EXAMPLES.

- | | | |
|----|------------------------|---|
| 1. | \$765 at 5 cents each. | Ans. 188 <i>d.</i> 25 <i>c.</i> |
| 2. | 360 at 8 cents each. | Ans. 28 <i>d.</i> 80 <i>c.</i> |
| 3. | 120 at 3 c. 4 m. each. | Ans. 4 <i>d.</i> 8 <i>c.</i> |
| 4. | 306 at 1 c. 7 m. each. | Ans. 5 <i>d.</i> 20 <i>c.</i> 2 <i>m.</i> |

Note. The three last examples were taken from Cases 1 and 2, Compound Multiplication.

CASE 3.

When the given price of an integer is more than one shilling, and less than two;

RULE.

Let the given quantity stand for so many shillings, to which add the amount in shillings of said quantity at the overplus price, found by Case 1 or 2, for the answer in shillings.

EXAMPLES.

1. 486 gallons, at $12\frac{1}{4}d.$ per gallon.

$\frac{1}{4}$	$\frac{1}{4}$	4 8 6
	12	1 2 1 $\frac{1}{4}$
		1 0 1 $\frac{1}{4}$
	2|0	49|6 1 $\frac{1}{4}$
Facit £. 24 16 1 $\frac{1}{4}$		

	<i>d.</i>		£.	s.	<i>d.</i>
2.	6100 at $13\frac{1}{4}$	Facit	£43	2	6
3.	1210 at $14\frac{1}{4}$		74	7	$3\frac{1}{4}$
4.	1260 at 15		78	15	0
5.	7121 at $16\frac{1}{4}$		482	3	$0\frac{1}{4}$
6.	2340 at $17\frac{1}{4}$		170	12	6
7.	7890 at $18\frac{1}{4}$		616	8	$1\frac{1}{4}$
8.	8900 at 19		704	11	8
9.	7120 at $20\frac{1}{4}$		600	15	0
10.	2100 at $21\frac{1}{4}$		188	2	6
11.	6812 at $22\frac{1}{4}$		645	14	5
12.	9999 at $23\frac{1}{4}$		989	9	$8\frac{1}{4}$
13.	19998 at $23\frac{1}{4}$		1978	19	$4\frac{1}{4}$
14.	12345 at 14		720.	2	6
15.	9876 at $17\frac{1}{4}$				
16.	7910 at $19\frac{1}{4}$		642	13	9
17.	6780 at $22\frac{1}{4}$				

Note. When the price of an integer is 10 cents, or more, but less than 100—Take the aliquot part or parts of a dollar, for the answer in dollars; or multiply as in Case 1, Compound Multiplication.

EXAMPLES.

1.	49 at 16 cents each.	<i>Ans.</i> 7 dol. 84 cts.
2.	194 at 52 cents each.	<i>Ans.</i> 100 dol. 88 cts.
3.	712 at 34 cents each.	<i>Ans.</i> 242 dol. 8 cts.
4.	507 at 75 cents each.	<i>Ans.</i> 380 dol. 25 cts.

CASE 4.

When the given price of an integer is any number of shillings under 20;

RULE.

Multiply the quantity by the price, for the answer in shillings; or,

If the price be even shillings, multiply by half the price, and double the first figure of the product for shillings, the rest of the product will be pounds; Or,

Work by aliquot parts.

EXAMPLES.

1. 486 bushels, at 2s. per bushel.

486	486	s.			
2	1		2	$\frac{1}{4}$	486
<u>2 | 097 | 2</u>	<u>48l. 12s.</u>				<u>48l. 12s.</u>

Facit 48l. 12s.

	s.		£.	s.	d.
2.	121 at 3	Facit	18	3	0
3.	471 at 5		117	15	0
4.	191 at 8		76	8	0
5.	242 at 11		133	2	0
6.	600 at 13		390	0	0
7.	171 at 16		136	16	0
8.	100 at 19		95	0	0
9.	612 at 9		275	8	0
10.	306 at 18		301	0	0
11.	860 at 7				
12.	430 at 14				

Note. When the price of an integer is dollars, or dollars and cents, multiply by the dollars, and take parts for the cents, if any.

Or, Multiply as in Case 1, Compound Multiplication.

EXAMPLES.

1. 341 at 1 dol. 45 cts. each. Ans. 494 dols. 45 cts.
 2. 75.5 at 4 dol. 35 cts. each. 328 dols. 42 cts. 5 m.
 3. 68.75 at 2 dol. 47 cts. each. 169 dols. 81 cts. 2.5 m.
 4. 317 at 2 dol. 12 cts. 5 mills, each. 673 dol. 62 cts. 5 m.

Note. The above examples were taken from Compound Multiplication.

CASE 5.

When the given price of an integer is shillings and pence, or shillings, pence, and farthings;

RULE.

Take such aliquot part or parts of the given quantity, as the price is of a pound; Or,

Multiply by the shillings, or dollars, and take parts for the rest; Or,

Multiply as in former cases.

EXAMPLES.

1. 7150 yards, at 1s. 8d. per yard.

s.	d.		d.		
1	8	$\frac{1}{2}$	6	$\frac{1}{2}$	7 1 5 0
			2	$\frac{1}{2}$	3 5 7 5
					1 1 9 1 8
				2/0	1 1 9 1 6 8

Facit £. 595 16 8

Proof £. 595 16 8

	s.	d.		£.	s.	d.
2.	569	at 2	6	Facit	71	2 6
3.	69	at 3	4		11	10 *0
4.	478	at 6	8		159	6 8
5.	400	at 13	4		266	13 4
6.	789	at 16	8		657	10 0
7.	765	at 69	cts.	Ans.	527	dol. 85 cts.
8.	841	at 1	dol. 58 cts.		1328	dol. 78 cts.
9.	807	at 1	dol. 97 cts.		1589	dol. 79 cts.
10.	969	at 2	dol. 39 cts.		2315	dol. 91 cts.
	s.	d.		£.	s.	d.
11.	244	at 5	8 $\frac{1}{2}$	Facit	69	12 10
12.	875	at 1	4 $\frac{3}{4}$		61	1 4 $\frac{1}{2}$
13.	7524	at 3	5 $\frac{1}{2}$		1301	0 6
14.	3715	at 9	4 $\frac{1}{2}$		1741	8 1 $\frac{1}{2}$
15.	2572	at 13	7 $\frac{1}{2}$		1752	3 6
16.	5144	at 6	9 $\frac{3}{4}$		4557	9 8 $\frac{1}{2}$
17.	4567	at 19	11 $\frac{1}{2}$			
18.	9134	at 9	11 $\frac{3}{4}$			

CASE 6.

When the price of an integer is pounds, or pounds, shillings, &c.

RULE.

Multiply the quantity by the pounds, and with the product add the amount at the remaining part of the price found as before.

Or multiply the quantity by the shillings of the price, and take parts for the rest.

EXAMPLES.

1. 428 tons, at 3*l.* 4*s.* 6½*d.* per ton.

<i>s.</i>					
4	½	428		428	
		3		64	
<i>d.</i>		1284		1712	
6	½	85	12	2568	
½	⅓	10	14		
		17	10	27392	
				½ = 214	
				⅓ = 17 10	
				2|0)2762|3 10	
				<i>£.</i> 1381 3 10	

	<i>£. s. d.</i>		<i>£. s. d.</i>
2.	26 at 11 14 0	Facit	304 4 0
3.	36 at 5 13 0		203 8 0
4.	47 at 7 <i>dol.</i> 60 <i>cts.</i>	Ans.	357 <i>dol.</i> 20 <i>cts.</i>
5.	156 at 7 <i>dol.</i> 92 <i>cts.</i>		1235 <i>dol.</i> 52 <i>cts.</i>
6.	78 at 15 <i>dol.</i> 84 <i>cts.</i>		<i>£. s. d.</i>
	<i>£. s. d.</i>		
7.	457 14 17 9½	Facit	6804 10 9½
8.	914 7 8 10½		
9.	500 at 12 19 11½		6498 19 2
10.	1000 at 6 9 11½		

CASE 7.

When both the price of an integer, and the quantity, are of divers denominations;

RULE.

Multiply the price by the integers of the quantity, and take parts of the price for those of the integers.

EXAMPLES.

1 17C. 3qr. 19lb. of sugar, at 2l. 2s. 6d. per Cwt.

qr.		£.	s.	d.
2	$\frac{1}{2}$	2	2	6 × 5
				12 + 5 = 17. Or, 4 × 4 + 1 = 17
		25	10	0
		10	12	6
1	$\frac{1}{2}$	1	1	3
16lbs.	$\frac{1}{4}$		10	7 $\frac{1}{2}$
2	$\frac{1}{8}$		6	0 $\frac{3}{4}$
1	$\frac{1}{2}$		9	
			4 $\frac{1}{2}$	

Facit £. 38 1 6 $\frac{3}{4}$ +

C. qr. lb.

2.	12 2 14	at 3l. 14s. 0d.	Facit 46l. 14s. 3d
3.	37 2 14	at 20dol. 10cts.	756dol. 26cts. 2.5m
4.	9 2 26	at 4l. 10s. 4 $\frac{1}{2}$ d.	43l. 19s. 6d
5.	5 2 10	at 7dol. 74cts.	43dol. 26cts. +
6.	59 1 14	at 1l. 8s. 7d.	84l. 17s. 1 $\frac{1}{2}$ d
7.	72 3 27	at 8l. 11s. 5d.	625l. 11s. 10d.
8.	0 2 14	at 9 dol.	5dol. 62cts. 5.1m.
9.	0 0 24	at 11dol. 64cts.	2dol. 49cts. 4.5m
10.	0 0 17	at 7dol. 84cts.	1dol. 19cts.

lb. oz. dwt. gr.

11.	27 10 0 0	at 0l. 1s. 4d. per lb.	17. 17s. 1 $\frac{1}{2}$ d
12.	13 10 12 8	at 10dol. 50cts. 145dol. 78cts. 9.5m. +	
13.	0 17 6 16	at 3l. 16s. 8d. per oz.	66l. 8s. 10 $\frac{1}{2}$ d.

Yds. qr.

14.	67 2	at 12s. 2d. per yard.	Facit 41l. 1s. 3a.
15.	68 1	at 97cts.	66dol. 20cts. 2.5m.
16.	419 3	at 12s. 6d.	262l. 6s. 10 $\frac{1}{2}$ d.
17.	839 2	at 70cts.	587dol. 65cts.

A. R. P.

18.	476 3 28	at 9dol.	} 4292dol. 32cts. 5m.
19.	953 3 16	at 4dol. 50cts.	

Application.

1.	18848 yds.	at $\frac{3}{4}$ per yd.	Facit 58l. 18s. 0d.
2.	6789 lb.	at 1 $\frac{1}{2}$ d. per lb.	49l. 10s. 0 $\frac{1}{2}$ d.
3.	3906 gal.	at 7cts. per gal.	273dol. 42cts.
4.	2004 oz.	at 10cts. per oz.	200dol. 40cts.

5. 12240 yds. at 1s. $3\frac{1}{2}d.$ per yard. 790l. 10s. 0d.
6. 1234 lb. at 1s. $11\frac{3}{4}d.$ per lb. 122l. 2s. $3\frac{1}{2}d.$
7. 987 gals. at 48 cts. per gal. 473 dol. 76 cts.
8. 543 gals. at 1 dol. 47 cts. per gal. 798 dol. 21 cts.
9. 138 bu. at 80 cts. per bu. 110 dol. 40 cts.
10. 800 bu. at 1 dol. 60 cts. per bu. 1280 dol.
11. 875 bu. at 37 cts. 5m. per bu. 328 dol. 12 cts. 5m.
12. 94 T. at 15 dol. 20 cts per ton. 1428 dol. 80 cts.
13. 156 T. at 13l. 16s. 8d. per ton. 2158l.
14. 2000 T. at 6l. 9s. $11\frac{3}{4}d.$ per ton. 12997l. 18s. 4d.
15. 4000 T. at 12l. 19s. $11\frac{1}{2}d.$ per ton. 51991l. 13s. 4d.
16. Bought 8 C. 1 qr. 16 lb. of tobacco, at 5l. 17s. 9d. per Cwt. what was the amount? Ans. 49l. 8s. 3d.
17. Sold 16 C. 2 qr. 17 lb. of sugar, at 2l. 15s. 11d. per Cwt. what was its value? Ans. 46l. 11s. 1d.
18. If 1 Cwt. of rice cost 9 dol. 30 cts. what is the value of 144 Cwt. 2 qr. 21 lb.? Ans. 1345 dol. 59 cts. 3.75m. +
19. Sold a pair of silver buckles, weighing 50 dwt. 20 gr. at 2 dol. 33 cts. per ounce; what did they come to? Ans. 5 dol. 92 cts. 2m. +
20. Bought 9 T. 19 C. 3 qr. $27\frac{3}{4}$ lb. of iron, at 39l. 19s. $11\frac{1}{2}d.$ per ton; what was the amount? Ans. 399l. 19s. 4d. +
21. Sold 19 T. 19 C. 3 qr. $27\frac{1}{2}$ lb. at 19l. 19s. $11\frac{3}{4}d.$ per ton; required the amount. Ans. 399l. 19s. 4d. +
22. A merchant sold 289 C. 1 qr. 14 lb. of beef, at 4 dol. 65 cts. per hundred weight; the value is required. Ans. 1345 dol. 59 cts. 3.75m. +
23. If a ton of hay be sold for 10 dol. 3 cts. what will 371 ton, 15 C. amount to? Ans. 3728 dol. 65 cts. 2.5m.
24. Bought 420 oz. 15 dwt. 16 gr. of gold, at 10 dol. 25 cts. per ounce; what is the value thereof? Ans. 4313 dol. 2 cts. 9m. +
25. Bought sundry pieces of cloth, containing 1157 yards, 2 qr. at 4 dol. per yard; what come they to? Ans. 4630 dol.
26. If land be rated at 15 dol. 73 cts. per acre; what is the value of a plantation, containing $1157\frac{1}{2}$ acres? Ans. 18207 dol. 47 cts. 5m.
27. Bought 7 casks of wine, each containing 84 gals. 1 qt. at 1 dol. 50 cts. per gallon; what did they amount to? Ans. 884 dol. $62\frac{1}{2}$ cts.
28. If a yard of cloth cost 39s. 4d. what is the value of 139 yards, 3 qr.? Ans. 274l. 16s. 10d.
29. Sold $279\frac{1}{2}$ yards of superfine scarlet cloth, at 3l. 18s. 8d. per yard; what did it amount to? Ans. 1099l. 7s. 4d.

30. What cost 5 qr. 2 na. of velvet, at the rate of 17s. 6d. per yard? *Ans.* 15s. 3½d.

31. What will 12 ounces of silk cost, if 1 lb. cost 9 dol. 40 cents? *Ans.* 7dol. 5cts.

TARE AND TRETT.

TARE and **Trett** are allowances made by the seller to the buyer, on some particular commodities.

Tare is the weight on the barrel, box, bag, or whatever contains the goods; and is either,

First, At so much in the whole gross weight;

Second, At so much per box, bag, &c. or,

Third, At so much per hundred weight.

Trett is an allowance for waste and dust, of 4 lb. in every 104 lb.

Gross is the weight of the goods, together with that in which they are contained.

Neat is the weight of the goods, after all allowances are deducted.

CASE 1.

When the tare is so much in the whole gross weight;

RULE.

Subtract the Tare from the Gross, and the remainder will be the Neat.

EXAMPLES.

1. What is the neat weight of 24 hogsheads of tobacco, each weighing 6 C. 2 qr. 17 lb. gross, tare in the whole 17 C. 3 qr. 27 lb. and how much is it worth, at 1l. 10s. 6d. per Cwt.?

C.	qr.	lb.	qr.	£.	s.	d.
6	2	17	$2 = \frac{1}{2}$	1	10	6×9
		$4 \times 6 = 24$				11
26	2	12		16	15	6
		6				12
159	2	16 gross.		201	6	0
17	3	27 tare.	lb.	13	14	6
			$14\frac{1}{2}$		15	3
141	2	17 neat.	$2\frac{1}{2}$		3	$9\frac{1}{2}$
			$1\frac{1}{2}$			$6\frac{1}{2}$
						$3\frac{1}{2}$
				Amount £.	216	0 $4\frac{1}{2}$

2. What is the neat weight of 456 C. 1 qr. 19 lb. of tobacco, tare in the whole 15 C. 2 qr. 13 lb. and what is the amount at 4 dol. 75 cts. per Cwt.?

Ans. neat 440 C. 3 qr. 6 lb. value 2093 dol. 81 cts. 6 m.

3. How much is the neat weight of 38 hogsheads of tobacco, weighing gross 201 C. 3 qr. 12 lb. tare in the whole 3140 lb. and what does it come to, at 4 dol. 50 cts. per Cwt.?

Ans. neat 173 C. 3 qr. 8 lb. value 782 dol. 19 cts. 6 m.

4. What is the neat weight of 5 casks of sugar, weighing as follows, viz. No. 1, 4 C. 2 qr. 14 lb. gross, tare 21 lb. No. 2, 3 C. 0 qr. 17 lb. gross, tare 18 lb. No. 3, 5 C. 3 qr. 10 lb. gross, tare, 1 qr. 11 lb. No. 4, 6 C. 1 qr. 16 lb. gross, tare 27 lb. No. 5, 3 C. 2 qr. 18 lb. gross, tare 19 lb. And the neat of the three first at 5 dol. 35 cts. per Cwt. of the other two at 6 dol. 90 cts. what do they amount to?

Ans. neat 22 C. 2 qr. 7 lb. amount to 135 dol. 65 cts. 5 m. +

CASE 2.

When the tare is so much per barrel, box, bag, &c.

RULE.

Multiply the number of bags, boxes, &c. by the tare; subtract the product from the gross, and the remainder will be the neat.

EXAMPLES.

1. What is the neat weight of 12 casks of raisins, each weighing 3 C. 2 qr. 10 lb. gross, tare 20 lb. per cask; and what is the value thereof, at 2l. 14s. 0d. per Cwt.?

C.	qr.	lb.	qr.	l.	s.	d.
3	2	10	2	2	14	0
		12				4
43	0	8 gross.	28	240	8	
2	0	16 tare.		224		
				2	0	16
40	3	20 neat.				
			1	108	0	0
			16lb.	1	7	0
			4		13	6
					7	8
					1	11
				Amount	7	110 10 1

2. In 70 bales of silk, each 317lb. gross, tare per bale 16lb. how many pounds neat, and what do they amount to, at 1 dol. 66cts. per lb. ? *Ans.* neat 21070lb. amount 34976dol. 20 cts.

3. What is the neat weight and value of 16 hogsheads of tobacco, weighing 86C. 2qr. 14lb. gross, tare 100lb. per hogshead; the neat sold at 9dol. 10cts. per Cwt. ?

Ans. neat 72C. 1qr. 10lb. value 658dol. 28cts. 7.5m. +

4. Sold 4 casks of indigo, weighing gross 18C. 2qrs. tare 37lb. per cask; what is the neat weight, and value thereof, at 54cts. per lb. ?

Ans. neat 17C. 0qr. 20lb. value 1038dol. 96cts.

CASE 3.

When the tare is at so much per hundred weight.

RULE.

Deduct from the gross such aliquot part or parts of it, as the tare is of an Cwt. the remainder will be the neat; Or,

Multiply the pounds gross by the tare per Cwt. and divide the product by 112, the quotient will be the tare, which deduct as before.

EXAMPLES.

1. In 12 butts of currants, each 7C. 1qr. 10lb. tare per Cwt. 16lb. how much neat, and what does it come to, at 3*l.* 7*s* 4*d.* per Cwt. ?

C. qr. lb.			£. s. d.		
7	1	10	3	7	4 × 3
		12			8
<hr/>			<hr/>		
16½	88	0 8 gross.	26	18	8
	12	2 9 tare.			9
<hr/>			<hr/>		
	75	1 27 neat.	242	8	0
			10	2	0
			0	16	10
				9	7½
				4	9½
				1	2½
				0	7
			<hr/>		
			Amount £. 254 3 0		

2. What is the neat weight and value of 40 bags of figs, gross 75 C. 3 qr. 14 lb. tare per hundred weight, 14 lb. at 18s. 6d. per Cwt. ? *Ans.* neat 66 C. 1 qr. 16 lb. value 61*l.* 8*s.* 3*d.*

3. Sold 9 hogsheads of sugar, each 6 C. 2 qr. 12 lb. gross, tare per hundred weight 17 lb. what is the neat weight, and what does it amount to, at 6 dol. 30 cts. per Cwt. ?

Ans. neat 50 C. 1 qr. 22 lb. amount 317 dol. 81 cts. 2.5m.

4. Bought 4 hogsheads of sugar, weighing 43 C. 3 qr. 21 lb. gross, tare 12 lb. per Cwt. required the neat weight, and its value, at 6 dol. 64 cts. per Cwt. ?

Ans. neat 39 C. 25 lb. 12 oz. value 260 dol. 48 cts. 6.59m. +

CASE 4.

When the trett is allowed with tare ;

RULE.

Deduct the tare as before, the remainder is called *suttle*, which divide by 26, the quotient will be the trett ; subtract this from the *suttle*, and the remainder will be the neat.

EXAMPLES.

1. In 27 bags of coffee, each 2 C. 3 qr. 17 lb. gross, tare 13 lb. per Cwt. trett 4 lb. per 104 lb. what is the neat weight ; and what is its value, at 3*l.* 18*s.* 9*d.* per Cwt. ?

<i>lb.</i>	<i>lb.</i>	<i>lb.</i>
8775 gross.	8775	26)7757(298 tr.
1018 tare.	13	52
<hr/>		
7757 <i>suttle.</i>	112)114075(1018 tare.	255
298 trett.	112	234
<hr/>		
Neat 7459 = 66 C. 2 qr. 11 lb.	207	217
	112	208
<hr/>		
Value 262 <i>l.</i> 4 <i>s.</i> 7 <i>d.</i>	955	9
	896	
<hr/>		
	59	

2. In 8 C. 3 qr. 20 lb. gross, tare 38 lb. trett 4 lb. in every 104 lb. how many lb. neat ; and what do they come to at 8*½d.* per lb. ? *Ans.* neat 925 lb. value 32*l.* 15*s.* 2*½d.*

3. Bought 120 C. 2 qr. gross of sugar, tare 176 lb. trett 4 lb. per 104 lb. what is the neat weight, and its value, at 5 dol. 24 cts. per Cwt. ? *Ans.* neat 114 C. 1 qr. 12 lb. value 599 dol. 23 cts. +

4. Sold 177 C. 22 lb. gross, tare 9 lb. per Cwt. trett 4 lb. per 104 lb. required the neat weight, and its amount at 8 dol. 88 cts. per Cwt. ?

Ans. neat 156 C. 2 qr. 22 lb. amount 1391 dol. 46 cts. +

INTEREST.

INTEREST is a consideration allowed for the use of money; relative to which are four particulars, viz.

First, The principal, or sum at interest.

Second, The time the principal is at use.

Third, The rate per cent. or interest of 100l. or dollars, for one year :

Or,—Ratio, the interest of 1l. or dollar, for one year.

Fourth, The amount, which is the sum of the principal and interest.

Interest is either Simple or Compound.

SIMPLE INTEREST.

Simple Interest is that which arises from the principal only.

Note. The ratio is the interest of 1l. or dollar, for one year, and is thus found :

£. or dol.	£. or dol.	£. or dol.	£. or dol.
As { 100 . . . 5 : : 105			
100 . . . 5.5 : : 1055			
100 . . . 6 : : 106, &c.			

Which is only dividing the rate per cent. by 100, by moving the point two places to the left.

TABLE OF RATIOS.

Rate per Cent.	Ratio.	Rate per Cent.	Ratio.
2	.02	4 $\frac{1}{2}$	.045
2 $\frac{1}{2}$	.0225	4 $\frac{3}{4}$	.0475
2 $\frac{1}{2}$	.025	5	.05
2 $\frac{3}{4}$	.0275	5 $\frac{1}{4}$	.0525
3	.03	5 $\frac{1}{2}$	.055
3 $\frac{1}{4}$	.0325	5 $\frac{3}{4}$	.0575
3 $\frac{1}{2}$	.035	6	.06
3 $\frac{3}{4}$	.0375	6 $\frac{1}{4}$	.0625
4	.04	6 $\frac{1}{2}$	.065
4 $\frac{1}{4}$	.0425	6 $\frac{3}{4}$	.0675

CASE 1.

When the time is any number of years, and the rate per cent. pounds or dollars only;

RULE—THE COMMON WAY.

Multiply the principal by the rate per cent. and divide the product by 100, the quotient will be the interest for one year, which multiply by the years given.

RULE—DECIMALLY.

Multiply the principal, ratio, and time together, the last product will be the interest, commission, brokerage, &c.

Note. The time must be in the denomination of years, with the parts (if any) annexed decimally.

PROOF.

By the Double Rule of Three. Or,
Work the same question by the common rule, and by decimals.

Note 1. To find the interest of any number of dollars, or of dollars and cents, always work by the decimal rule.

2d. The rule decimally, comprises Cases 1, 2, 3, and 4, by the common rules.

EXAMPLES.

1. What is the interest of 537*l.* 10*s.* for 5 years, at 6 per cent. per annum?

Common way.

£. s.
537 10
6

£. 32)25 0
20

£. 32 5)00
5

£. 161 5 *Ans.*

Decimally.

£.
537.5
.06

32.250
5

£. s.
£. 161.25 = 161.5 *Ans.*

2. What is the interest of 87*l.* 14*s.* 5*d.* for one year, at 6 per cent. per annum? *Ans.* 5*l.* 5*s.* 3*d.*

3. What is the amount of 173*l.* 17*s.* 8½*d.* for a year, at 7 per cent. per annum? *Ans.* 186*l.* 1*s.* 1½*d.*

4. What is the amount of a bond for 465 dol. 86 cts. at the end of 9 years, at 5 per cent. per annum?

Ans. 675 dol. 49 cts. 7m.

5. What is the interest of 476 dol. for 4 years, at 5 per cent. per annum? *Ans.* 95 dol. 20 cts.

6. How much is the amount of 702 dol. 63 cts. for one year, at 6 per cent. per annum? *Ans.* 744 dol. 78 cts. 7.8m.

7. Suppose a bond for 573.25 dol. to be at interest for 3 years, at 6 per cent. per annum; what is the amount? *Ans.* 676 dol. 43 cts. 5m.

CASE 2.

When the rate per cent. is $\frac{1}{4}$, $\frac{1}{2}$, or $\frac{3}{4}$, more than the pounds, or dollars given;

RULE—THE COMMON WAY.

To the product made by the pounds, or dollars, add $\frac{1}{4}$, $\frac{1}{2}$, or $\frac{3}{4}$, of the principal, and divide by 100 for the interest required.

RULE—DECIMALLY.

The same as Case 1.

EXAMPLES.

1. What is the interest of 246*l.* 18*s.* for 5 years, at $4\frac{1}{4}$ per cent. per annum?

Common way.

$$\begin{array}{r} \text{£. s.} \\ 246 \ 18 \\ \quad 4\frac{1}{4} \\ \hline 987 \ 12 \\ 61 \ 14 \ 6 \end{array}$$

$$\begin{array}{r} \text{£. s. d.} \\ 10 \ 9 \ 10\frac{1}{4} \\ \quad 5 \\ \hline 52 \ 9 \ 3\frac{1}{4} \end{array}$$

Ans.

$$\begin{array}{r} \text{£. 10} \mid 49 \ 6 \ 6 \\ \quad 20 \\ \hline \end{array}$$

$$\begin{array}{r} \text{s. 9} \mid 86 \\ \quad 12 \\ \hline \end{array}$$

$$\begin{array}{r} \text{d. 10} \mid 38 \\ \quad 4 \\ \hline \end{array}$$

$$\begin{array}{r} \text{gr. 1} \mid 52 \\ \hline \end{array}$$

Decimally.

$$\begin{array}{r} \text{£.} \\ 246.9 \\ .0425 \\ \hline \end{array}$$

$$\begin{array}{r} 12345 \\ 4938 \\ 9876 \\ \hline \end{array}$$

$$10.49325$$

$$5$$

$$\text{£. 52.46625}$$

$$\text{£. 52 \ 9 \ 4 \ Ans.}$$

2. Calculate the interest of a bond for 1142 dol. 36 cts. for 2 years, at $5\frac{1}{4}$ per cent. per annum. *Ans.* 131 dol. 37 cts. 1.4m.
3. What sum will 2925 dol. 62 cts. amount to in 4 years, at $6\frac{1}{2}$ per cent. per annum? *Ans.* 3686 dol. 28 cts. 1.2 m.
4. What is the interest of 321 dol. for 1 year, at $5\frac{1}{4}$ per cent. per annum? *Ans.* 17 dol. 65 cts. 5 m.
5. What is the amount of 273.45 dol. for 2 years, at $5\frac{1}{4}$ per cent. per annum? *Ans.* 304 dol. 89 cts. 6.75 m.
6. How much will 97.5 dollars, at $6\frac{1}{4}$ per cent. per annum, amount to in three years? *Ans.* 115 dol. 78 cts. 1.25 m.

CASE 3.

When the time given is months, weeks, or days, less or more than a year;

RULE—THE COMMON WAY.

As the months, weeks, or days in a year,
Are to the interest of the given sum for a year,
So are the months, weeks, or days in the time given,
To the interest required.

Or, take the aliquot parts of the yearly interest, for the given parts of a year.

RULE—DECIMALLY.

The same as Case 1, the parts of the year being decimally expressed.

EXAMPLES.

1. What will 300 $\frac{1}{2}$ amount to in 5 years and 10 months, at $4\frac{1}{4}$ per cent. per annum?

Common way.

$\frac{1}{2}$	l.	mo.	l.	s.	mo.	l.	s.	d.	
	300	As 12	14	5	:: 70	83	2	6	Interest
	$4\frac{1}{4}$					300	0	0	Principal.

383 2 6 *Ans.*

$\frac{1}{2}$	l.	1200
	150	
	75	

l. 14	25
	20

s. 5 | 00

Decimally.		Or thus :	
l.	no.	l.	s.
300	6	14	5 Interest for 1 year.
.0475	4		5 years.
<hr/> 14.2500		<hr/> 71	5
5.8333		7	2 6
<hr/> 83.124525		<hr/> 4	15 0
300		<hr/> 83	2. 6 Interest.
<hr/> 383.124525		300	0 0 Principal.
<hr/> l. 383 2 6 Ans.		<hr/> 383	2 6 Amount.

2. What is the interest of 57*l.* 17*s.* 8*d.* for three months, at 6 per cent. per annum? *Ans.* 17*s.* 4*d.*

3. How much is the interest of 150*l.* 19*s.* for 3 years and 4 months, at 6 per cent. per annum? *Ans.* 30*l.* 3*s.* 9*d.*

4. What is the interest of 339 dol. 60 cts. for 16 weeks, at 4½ per cent. per annum? *Ans.* 4 dol. 70 cts. 2 m. +

5. How much is the amount of 650 dol. 27 cts. for 146 days, at 5½ per cent. per annum? *Ans.* 665 dol. 22 cts. 6 m. +

6. What is the interest of 189 dol. 52 cts. for 1 year, 5 months, and 25 days, at 6 per cent. per annum? *Ans.* 16 dol. 89 cts. 8 m.

7. What is the interest of 523 dol. 50 cents, for 4 years and 3 months, at 5¼ per cent. per annum?

Ans. 116 dol. 80 cts. 6 m. nearly.

8. What is the amount of 256 dol. for one year and 6 months, at 5½ per cent. per annum? *Ans.* 278 dol. 8 cts.

9. How much will 312.5 dol. at 6¼ per cent. per annum, amount to, in 4 years and 9 months?

Ans. 405 dol. 27 cts. 5.4 m. +

10. If 221.75 dol. be at interest for 3 years, 7 months, and 6 days; how much is the amount at 6 per cent. per annum?

Ans. 269 dol. 64 cts. 8 m.

Note 1. The interest of any sum in dollars for any number of months, may be concisely found by the following

RULE.

Multiply the principal by half the number of months; the product will be the interest in cents, at 6 per cent. per annum; and for any other rate per cent. take aliquot parts, and add or subtract.

Simple Interest.

EXAMPLES.

1. What is the interest of 3472 dols. 56 cts. for 9 months at 6 per cent. per annum; also at 7, and at 5 per cent. per annum?

$$3472.56$$

$$\frac{1}{4} \text{ of 9 months} = 4.5$$

$$1736280$$

$$1389024$$

$$\left| \frac{1}{4} \right| 15626.520 = 156 \text{ dol. } 26 \text{ ct. } 5.2 \text{ m. at 6 per ct. } 2604.42$$

$$18230.94 = 182 \text{ dol. } 30 \text{ ct. } 9.4 \text{ m. at 7 per ct.}$$

$$13022.10 = 130 \text{ dol. } 22 \text{ ct. } 1 \text{ m. at 5 per cent.}$$

2. What will 721 dol. amount to, in fourteen months, per cent. per annum? Ans. 771 dol. 4

3. How much is the interest of 7342 dol. for 16 months and half, at 6 per cent. per annum? Ans. 605 dol. 71 cts.

4. What is the interest of 576 dol. for 21 months and quarter, at 6, and at 7 per cent. per annum?

$$\text{Ans. } \left\{ \begin{array}{l} 61 \text{ dol. } 20 \text{ cts. at 6 per} \\ 71 \text{ dol. } 40 \text{ cts. at 7 per} \end{array} \right.$$

5. How much is the interest of 1368 dol. for 35 months and 3 quarters, at 6 and at 5 per cent. per annum?

$$\text{Ans. } \left\{ \begin{array}{l} 244 \text{ dol. } 53 \text{ cts. at 6 per ct.} \\ 203 \text{ dol. } 77 \text{ cts. } 5 \text{ m. at 5 per} \end{array} \right.$$

Note 2. If the days be not $\frac{1}{4}$, $\frac{1}{2}$, or $\frac{3}{4}$ of a month, reduce days to the decimal of a month; then multiply by half the months for the interest in cents as before.

EXAMPLES.

1. What is the interest of 3475 dol. for 9 months and 12 days at 6 per cent. also at 7 and at 5 per cent. per annum?

$$30) \quad 12.0 \quad 3475$$

$$\frac{1}{4} \quad 9.4 = \quad 4.7$$

$$24325$$

$$13900$$

	d.	c.	m.	
$\frac{1}{4}) 163,32.5 = 163$	32	5	at 6	} per cent.
272208 +				
190,54.58 = 190	54	5.8	at 7	
136,10.42 = 136	10	4.2	at 5	

2. What is the interest of 987 dol. 78 cts. for 18 months and 18 days, at 6 per cent. per annum? *Ans.* 91dol. 86cts. 3.54m.

3. What is the amount of 5186 dol. for 21 months, and 25 days, at 6 per cent. per annum? *Ans.* 5752dol. 13cts. 8m. +

4. How much will be the amount of a bond, for 875 dol. 49 cts. for 5 years, 8 months, and 20 days, at 6 per cent. ?—also at 7 and at 5 per cent. per annum?

Ans. $\left\{ \begin{array}{l} 1176 \text{ dol. } 7 \text{ cts. } 4.9\text{m.} + \text{at } 6 \text{ per cent.} \\ 1226 \text{ dol. } 17 \text{ cts. } 2.3\text{m.} + \text{at } 7 \text{ per cent.} \\ 1125 \text{ dol. } 97 \text{ cts. } 7.5\text{m.} + \text{at } 5 \text{ per cent.} \end{array} \right.$

CASE 4.

INSURANCE, COMMISSION, AND BROKAGE.

Insurance, Commission, and Brokage, are allowances made to insurers, factors, or brokers, at a stipulated rate per cent.

RULE—THE COMMON WAY.

For the insurance, or commission, work as if to find the interest of the given sum at the proposed rate, for one year, and for the brokage, say,

As 100*l.* or dollars, or one dollar, is to the rate,

So is the given sum, to the brokage required.

RULE—DECIMALLY.

The same as Case 1, for the Insurance or Commission; and for the brokage as above, the terms being put in decimals.

EXAMPLES.

1. A factor has disbursed upon his employer's account, the sum of 1009*l.* 18*s.* what must be demanded for his commission, at $2\frac{1}{2}$ per cent.?

Common way.

	£.	s.	d.		£.	s.	d.
$\frac{1}{4}$	1009	18	0	<i>Ans.</i>	22	14	$5\frac{1}{4}$
		$2\frac{1}{2}$					

2019 16
252 9 6

£. 22 | 72 5 6
20

s. 14 | 45
12

d. 5 | 46
4

qr. 1 | 84

Decimally.

£. 1009.9
.0225

50495

20198

20198

£. 22.72275

£. 22 14 $5\frac{1}{4}$ *Ans.*

2. What is the insurance of an East-India ship and cargo, valued at 7406*l.* 17*s.* 6*d.* at 15 $\frac{3}{4}$ per cent.?

Ans. 1166*l.* 11*s.* 7 $\frac{1}{2}$ *d.*

3. Suppose 1 $\frac{1}{4}$ per cent. be allowed for commission; what must be demanded on 704*l.* 15*s.* 4*d.*?

Ans. 12*l.* 6*s.* 8*d.*

4. What is the brokerage of 700*l.* 14*s.* 6*d.* at 4*s.* per cent.?

Ans. 1*l.* 8*s.* 0 $\frac{1}{2}$ *d.*

5. What may a broker demand on 420*l.* 12*s.* 6*d.* at 6*s.* 4*d.* per cent.?

Ans. 1*l.* 6*s.* 7 $\frac{1}{2}$ *d.*

6. The value of a ship and cargo is 8560*l.* what is the insurance at 35 per cent.?

Ans. 2996*l.*

7. What is the commission on 312 dollars, at 12 cents per dollar?

Ans. 37 dol. 44 cts.

8. What is the brokerage on 542.5 dol. at 20 cents per cent.?

Ans. 1 dol. 8 cts. 5 m.

9. What is the brokerage on 412 dol. at 30 cents per cent.?

Ans. 1 dol. 23 cts. 6 m.

10. How much must a broker have on 352.73 dol. at 4 $\frac{5}{8}$ cents per cent.?

Ans. 1 dol. 60 cts. 5 m. nearly.

CASE 5.

To find the principal, when the amount, time, and rate per cent. are given.

RULE—THE COMMON WAY.

As the amount of 100*l.* or dollars, at the rate and time given;

Is to 100*l.* or dollars;

So is the amount given,

To the principal required.

RULE—DECIMALLY.

To the product of the ratio by the time, add 1; and by that sum divide the amount: the quotient will be the principal required.

EXAMPLES.

1. What principal at interest for 9 years, at 5 per cent. per annum, will amount to 725*l.*

Common way.

5*l.*
9
—
45
100
—

Decimally.

.05
9
—
1.45)725.00(500 *Ans.*
725
—

As 145*l.* ... 100*l.* :: 725*l.* ... 500*l.* *Ans.*

2. What sum at interest for 9 years and 6 months, at $4\frac{1}{2}$ per cent. per annum, will amount to 856 dol. 50 cts. *Ans.* 600 dol.

3. What sum at interest for 4 years, at 5 per cent. per annum, will amount to 571 dol. 20 cts. ? *Ans.* 476 dol.

4. What principal will amount to 965 dol. 57 cts. 5 m. in 5 years, at 6 per cent. per annum ? *Ans.* 742 dol. 75 cts.

CASE 6.

To find the rate per cent. when the amount, time, and principal are given;

RULE—THE COMMON WAY.

As the product of the time and principal,
Is to the interest for the whole time ;
So is 100*l.* or dollars,
To the rate per cent.

RULE—DECIMALLY

Divide the whole interest, by the product of the time and principal,—and the quotient will be the ratio.

EXAMPLES.

1. At what rate per cent. per annum, will 500*l.* amount to 725*l.* in 9 years ?

Common way.

<i>£</i>	<i>£</i>
500	725
9	500

As 4500*l.* . . 225 : : 100*l.* . . 5*l.*

Ans. 5 per cent.

Decimally.

<i>£</i>	<i>£</i>
500	725
9	500

4500)225.00(.05 Ratio, *Answer.*
225.00

00000

2. At what rate per cent. will 600 dol. amount to 856 dol. 50 cts. in 9 years and 6 months ? *Ans.* $4\frac{1}{2}$ per cent.

3. At what rate per cent will 742 dolls. 75 cts. in 5 years, amount to 965 dolls. 57 cts. 5 m. ? *Ans.* 6 per cent.

4. Suppose 837 dollars, at interest 4 years, amount to 1029 dolls. 51 cts. what was the rate per cent ? *Ans.* $5\frac{1}{2}$ per ct.

CASE 7.

To find the time, when the principal, amount, and rate per cent. are given.

RULE—THE COMMON WAY.

As the interest of the principal for one year,
Is to one year;
So is the whole interest,
To the time required.

Note. If the interest for one year be found decimally, the above rule will so apply.

EXAMPLES.

1. In what time will 500*l.* amount to 725*l.* at 5 per cent. per annum ?

£. Year. £.

As 25 . . 1 :: 225 . . 9 years, *Answer.*

2. In what time will 600 dolls. amount to 856 dolls. 50 cts. at $4\frac{1}{2}$ per cent. per annum ? *Ans.* 9y. 6m.

3. A testator left his son, besides providing for his education, &c. 750*l.* to receive the amount thereof at 5 per cent. when he should arrive at the age of 21 years, which his guardian then found to be 1096*l.* 17*s.* 6*d.* how old was the boy at his father's decease ? *Ans.* 11 years, 9 mo.

4. In what time will 742 dolls. 75 cts. amount to 965 dolls. 57 cts. 5m. at 6 per cent. per annum ? *Ans.* 5 years.

5. In what time will 837 dolls. amount to 1029 dolls. 51 cts. at $5\frac{1}{2}$ per cent. per annum ? *Ans.* 4 years.

6. Suppose 312 dolls. at 6 per cent. per annum, amount to 377 dolls. 52 cts. how long was it at interest ? *Ans.* $3\frac{1}{2}$ years.

A TABLE

Of Days for any given time less than a Year.

Days.	1st Month.	2d Month.	3d Month.	4th Month.	5th Month.	6th Month.	7th Month.	8th Month.	9th Month.	10th Month.	11th Month.	12th Month.
1	1	32	60	91	121	152	182	213	244	274	305	335
2	2	33	61	92	122	153	183	214	245	275	306	336
3	3	34	62	93	123	154	184	215	246	276	307	337
4	4	35	63	94	124	155	185	216	247	277	308	338
5	5	36	64	95	125	156	186	217	248	278	309	339
6	6	37	65	96	126	157	187	218	249	279	310	340
7	7	38	66	97	127	158	188	219	250	280	311	341
8	8	39	67	98	128	159	189	220	251	281	312	342
9	9	40	68	99	129	160	190	221	252	282	313	343
10	10	41	69	100	130	161	191	222	253	283	314	344
11	11	42	70	101	131	162	192	223	254	284	315	345
12	12	43	71	102	132	163	193	224	255	285	316	346
13	13	44	72	103	133	164	194	225	256	286	317	347
14	14	45	73	104	134	165	195	226	257	287	318	348
15	15	46	74	105	135	166	196	227	258	288	319	349
16	16	47	75	106	136	167	197	228	259	289	320	350
17	17	48	76	107	137	168	198	229	260	290	321	351
18	18	49	77	108	138	169	199	230	261	291	322	352
19	19	50	78	109	139	170	200	231	262	292	323	353
20	20	51	79	110	140	171	201	232	263	293	324	354
21	21	52	80	111	141	172	202	233	264	294	325	355
22	22	53	81	112	142	173	203	234	265	295	326	356
23	23	54	82	113	143	174	204	235	266	296	327	357
24	24	55	83	114	144	175	205	236	267	297	328	358
25	25	56	84	115	145	176	206	237	268	298	329	359
26	26	57	85	116	146	177	207	238	269	299	330	360
27	27	58	86	117	147	178	208	239	270	300	331	361
28	28	59	87	118	148	179	209	240	271	301	332	362
29	29		88	119	149	180	210	241	272	302	333	363
30	30		89	120	150	181	211	242	273	303	334	364
31	31		90		151		212	243		304		365

THE USE OF THE TABLE.

First, To know the number of days, from the beginning of the year, to any given day of any month;

This is obtained by inspection only.

Secondly, To find the number of days from any day in any month, to the end of the year;

Suppose from 10th of 9mo.

From	-	-	-	-	-	-	363
Take the days answering to 10th 9mo.	-	-	-	-	-	-	253
Remains	-	-	-	-	-	-	Days 112

Thirdly, To find the number of days between different dates:

Suppose the 9th of the fifth month, and the 5th of the 11th month.

From the number answering to 5th 11 mo.	309
Take that of the 9th 5th mo.	129
Remains	Days 180

Fourthly, To find the number of days from a given date, to some other in the year following:

Suppose from 12th 10th mo. to 10th 6mo. ensuing.

From	-	-	-	-	-	-	363
Take the number answering to 12th 10th mo.	-	-	-	-	-	-	285
							80
To which add to the 10th 6 mo.							161
Days required	-	-	-	-	-	-	241

Note. If the intercalary day of a leap-year intervene, one day must be added to these found as before.

COMPOUND INTEREST.

COMPOUND Interest, is that which arises from a principal, increased by its interest, as the interest becomes due.

The ratio for Compound Interest, is the amount of one pound or dollar, for one year, at the given rate.

IT IS THUS FOUND.

L. or *dol.* L. or *dol.* L. or *dol.* L. or *dol.*
As 100 : 106 : : 1 : 1.06, &c.

Or, by adding the rate per cent. to 100% or dollars, and moving the decimal point of the sum two places toward the left hand.

CASE 1.

When the time is any number of years ;

RULE—THE COMMON WAY.

Find the first year's amount by simple interest, which will be the principal for the second year ; and the amount of this, will be the principal for the third year, &c.

From the last amount, take the given principal, and the remainder will be the Compound Interest.

RULE—DECIMALLY.

Multiply the principal by the ratio, and that product again by the ratio, &c. as often as there are years in the time : the last product will be the amount for the last year—From which take the given principal, and the remainder will be the Compound Interest.

Note. The other cases will be in the latter part of the book.

EXAMPLES.

1. What is the compound interest of 450*l.* 10*s.* for 3 years, at 5 per cent. per annum?

The common way.

£. 450 10
5

£. 22)52 10
20

s. 10)50
12

d. 6)00

£. 22 10 6
450 10 0

Amount 1st year, 473 0 6
5

£. 23)65 2 6
20

s. 13)02
12

d. 30
4

qr. 1)20

£. 23 13 0½
473 0 6

2d year, 496 13 6½
5

£. 24)83 7 7½
20

s. 16)67
12

d. 8)11

Decimally.

£. 450.5
1.05

22525
4505

1st. year's amount, 473.025
1.05

2365125
473025

2d. year's amount, 496.67625
1.05

248338125
49667625

3d year's am't. 521.5100625
Principal, 450.5

£. 71.0100625

Ans. £. 71 0 2½

£ s. d.
24 16 8
496 13 6½

3d year, 521 10 2½
Deduct Principal, 450 10 0

Comp'd Interest, £. 71 0 2½
Answer.

2. What will 400*l.* amount to in 4 years, at 6 per cent. per annum? *Ans.* 504*l.* 19*s.* 9*d.*

3. How much is the compound interest of 1152 dol. for 6 years, at 5 per cent. per annum? *Ans.* 391.7917 dol. +

4. What will 1200 dol. amount to in 4 years, at 4½ per cent. per annum? *Ans.* 1417.375 dol.

5. What is the compound interest of 961.2 dol. at 3½ per cent. per annum, for 3 years? *Ans.* 104.4996 dol.

REBATE OR DISCOUNT.

REBATE or **Discount** is an abatement for the payment of money before due, by accepting so much as would amount to the whole debt at the time payable, at a given rate.

RULE.

As the amount of 100*l.* or dollars at the rate and time given,

Is to 100*l.* or dollars,

So is the whole debt,

To the present worth; (*See case 5th, Simple Interest.*)

Subtract the present worth from the whole debt, and the remainder will be the rebate.

Note. The same rule decimally, by so expressing the parts or annexing cyphers to the remainder.

PROOF.

Find the amount of the present worth for the time and rate proposed, which must equal the given sum.

Note. Rebate or Discount, is not the Interest of the sum due, (as some mistake it) but of the present worth. *See example 7.*

EXAMPLES.

1. What is the rebate of 795*l.* 11*s.* 2*d.* for 11 months, at 6 per cent. per annum?

m. £. m. £. s.

As 12 ... 6 :: 11 ... 5 10

100 0

Amount, 105 10

<i>£</i>	<i>s.</i>	<i>£.</i>	<i>£.</i>	<i>s.</i>	<i>d.</i>	<i>£.</i>	<i>s.</i>	<i>d.</i>
As	105	10	100	::	795	11	2	754 1 8
					<i>£.</i>	<i>s.</i>	<i>d.</i>	
					795	11	2	
					754	1	8	present worth.
					<hr/>			
					41	9	6	Rebate. <i>Ans.</i>
					<hr/>			

2. What is the present worth of 161*l.* 10*s.* for 19 months discount at 5 per cent. ? *Ans.* 149*l.* 13*s.* 0*d.*

3. Sold goods for 796 dol. 49 cts. to be paid in 4 months hence ; what is the present worth at 3 per cent. ?

Ans. 788 dol. 60 cts. 3.9*m.*

4. What is the rebate of 270.24 dol. for 20 months, at 7 per cent. ? *Ans.* 28.2325 dol.

5. Sold goods for 748.8 dol. one half to be paid at 3 months, and the other half at 6 months ; what must be discounted for present payment at 5 per cent. ? *Ans.* 13.755 dol.

6. What is the present worth of 240 dol. one half payable at four months, and the other at 8 months ; discount at 5 per cent. ? *Ans.* 234 dol. 16 cts.

7. What difference is there between the interest of 1200 dol. at 5 per cent. per annum for twelve years, and the discount of the same sum, at the same rate, and for the same time ?

Ans. 270 dol

Note. To find the discount of any number of dollars, for days, divide the given sum by 100, and the quotient will be the discount for 60 days, as used in several banks in the United States : or multiply the given sum by the number of days, and divide the product by 6, the quotient will be the discount in mills.

EXAMPLES.

1. What is the discount on 100 dollars, for 60 days, at 6 per cent. ? *Ans.* 1 dol. discount in the bank.

2. What would be the discount on 3250 dollars, for 63 days ? *Ans.* 34 dol. 12 cts. 5*m.* in the bank.

3. How much is the discount on 842 dol. for 93 days ? *Ans.* 13 dol. 5 cts. in the bank.

4. What is the discount on 4780 dollars, for 35 days ? *Ans.* 27 dol. 88 cts. + in the bank.

EQUATION.

EQUATION is the method of reducing several stated times, at which money is payable, to one mean, or equated time.

RULE.

Multiply each payment by its time, and divide the total of the products by the sum payable at the time required; the quotient will be the equated time.

PROOF.

The interest of the sum payable at the equated time, at any given rate, will equal the interest of the several payments for their respective times.

EXAMPLES.

1. A owes B 100*l.* of which 50*l.* are to be paid at 2 months, and 50*l.* at 4 months; but they agree to reduce them to one payment: when must the whole be paid?

$$50 \times 2 = 100$$

$$50 \times 4 = 200$$

$$\begin{array}{r} 100 \overline{)300} \\ 300 \\ \hline \end{array}$$

Ans. 3 M.

2. A merchant has owing to him 300 dol. to be paid as follows, viz. 50 dol. at 2 months, 100 dol. at 5 months; and the rest at 8 months; but it is agreed to make one payment of the whole: when will that time be?

Ans. 6 months.

3. F owes H 2400 dol. of which 480 dol. are to be paid present, 960 dol. at 5 months, and the rest at 10 months; but they agree to make one payment of the whole, and wish to know the time.

Ans. 6 months.

4. C owes D a sum of money which is to be discharged, viz. $\frac{1}{2}$ at 2 months, $\frac{1}{4}$ at 4 months, $\frac{1}{8}$ at 6 months, and $\frac{1}{8}$ at 8 months, but they agreeing to make one payment of the whole, the equated time is required.

Ans. 5 months.

5. E is indebted to F 576 dol. which by agreement is to be paid 5 months hence, but E is willing to pay him 96 dol. present, provided he will give him longer time to pay the remainder, which is agreed on; the time of payment therefore is required.

Ans. 6 months.

6. P owes Q 1008 dol. which will be due 6 months hence, but P is willing to pay him 144 dol. present, provided he can have the remainder forborne a longer time, to which Q agrees; the time of payment is required.

Ans. 7 months.

BARTER.

BARTER is the exchanging of one commodity for another, by duly proportioning their quantities and values.

Note. By annexing aliquot parts decimally, reductions are frequently avoided.

RULE.

Work by the Rule of Three, or by Practice, as the tenor of the question may require.

EXAMPLES.

1. How much sugar at 9*d.* per lb. should be bartered for 6½ Cwt. of tobacco, at 14*d.* per lb.?

$$\begin{array}{ccccccc} \text{lb.} & \text{d.} & \text{C. gr.} & \text{d.} & & & \\ \text{As } 1 & \dots & 14 & :: & 6 & 2 & \dots 10192 \\ \text{d.} & \text{lb.} & \text{d.} & \text{C. gr. lb.} & & & \end{array}$$

Then, As 9 . . 1 :: 10192 . . 10 0 12½ *Ans.*

2. What quantity of tea, at 10*s.* per lb. must be given for 1 Cwt. of chocolate, at 4*s.* per lb.?

Ans. 44lb. 12oz. +

3. How much rice, at 28*s.* per Cwt. must be bartered for 3½ C. of raisins, at 5*d.* per lb.?

Ans. 5C. 3qr. 9lb. +

4. A has linen cloth worth 20 cts. an ell ready money, but in barter he will have 24 cts.; B has broad-cloth worth 1 dol. 93 cts. per yard ready money; at what price ought the broad-cloth to be rated in barter?

Ans. 2dol. 31cts. 6m.

5. Suppose C has tea at 1 dol. 13 cts. per lb. ready money, but in barter he will have 1 dol. 33 cts. per lb. D has tobacco worth 20 cts. per lb. ready money; how must he rate his tobacco per lb. to equal the tea in value?

Ans. 23 cts. 5 m. +

6. A has nutmegs worth 1 dol. per lb. ready money, but in barter will have 1 dol. 13 cts. per lb. D has tobacco worth 10 cts. per lb. ready money; how must D rate his tobacco that his profits may be equivalent with A's?

Ans. 11cts. 3m.

7. A had 41 Cwt. of iron, at 4 dol. per Cwt. for which B gave him 53 dol. 33 cts. in money, and the rest in pork at 5 cts. 5 m. per lb. how much pork must be given besides the 53 dol. 33 cts.?

Ans. 2012.18lb. +

8. A has 320 dozen of candles, at 1 dol. 8 cts. per doz. for which B agrees to pay him 144 dol. in cash, and the rest in cotton at 16 cts. per lb. how much cotton must B give A?

Ans. 1260 lb.

9. K has 75 sheep, at 1 dol. 74 cts. each, for which L is to give him 42 dol. 24 cts. and the rest in Indian corn at 42 cts. per bushel; how much corn must L give K?

Ans. 210 bu. 4.5 qts. +

10. A and B bartered; A had 5 C. of sugar, at 6 cts. per lb. which he gave B for a quantity of cinnamon at 1 dol. 28 cts. per lb. how much cinnamon did B give A?

Ans. 26 lb. 4 oz.

11. B delivered 3 hogsheads of brandy, at 6s. 8d. per gallon, to C, for 126 yards of cloth; what was the cloth per yard?

Ans. 10s

12. C has candles at 1 dol. 44 cts. per dozen ready money but in barter he will have 1 dol. 56 cts. per dozen. D has cotton at 18 cts. per lb. ready money; what price must the cotton be at in barter, and how much must be bartered for 100 dozen of candles?

Ans. the cotton at 19 cts. 5 m. per lb. and 800 lb. must be given for 100 dozen of candles.

13. A has linen at 10 cts. the ell ready money, but in barter 12 cts. B has 3610 lb. of sugar at 7 cts. 5 m. ready money, and will have of A 84 dol. in cash, and the rest in linen; at what rate is the sugar in barter, and how much linen must A give B?

Ans. the sugar at 9 cts. per lb. and 1867½ ells.

14. Two merchants barter; A receives 20 Cwt. of cheese at 2 dol. 87 cts. per Cwt. B 8 pieces of linen, at 9 dol. 78 cts. per piece; which of them must receive money, and how much?

Ans. A 20 dol. 84 cts.

15. If 24 yards of cloth be given for 5 C. 1 qr. of tobacco, at 5 dol. 7 cts. per Cwt. what is the cloth rated at per yd.?

Ans. 1 dol. 11 cts. nearly.

16. A barter 40 yards of cloth at 98 cts. per yard, with B for 28½ lb. of tea, at 1 dol. 58 cts. per lb. which must pay balance, and how much?

Ans. A 4 dol. 40 cts. 5 m.

17. A has 7½ Cwt. of sugar at 8 cts. per lb. for which B gave him 12½ Cwt. of cheese; what was the cheese rated at per lb.?

Ans. 4 cts. 8 m.

18. What quantity of sugar at 8 cts. per lb. must be given in barter for 20 Cwt. of tobacco, at 8 dols. per Cwt.?

Ans. 17 Cwt. 3 qr. 12 lb.

19. P has coffee, which he barter with Q, at 11 cts. per lb. more than it cost him, against tea, which stands Q in 1 dol. 38 cts. the lb. but he puts it at 1 dol. 66 cts. query the prime cost of the coffee?

Ans. 44 cts. 3 m. +

20. A and B barter; A has $12\frac{1}{2}$ Cwt. of hops at 7 dol. 50 cts. per Cwt. but in barter insists on 8 dol. B has wine worth 66 cts. a gallon, which he raises in proportion to A's demand; on the balance, A received but a hhd. of wine; what had he in ready money? *Ans.* 55 dol. 64 cts. 8m.

LOSS AND GAIN.

Loss and Gain is a method of computing the profit or loss in the purchase or sale of goods, &c.

Note. Observe the note in Barter.

RULE.

Work by the Rule of Three, or by Practice, as the nature of the question may require.

EXAMPLES.

1. Bought 18 C. of iron, at 28s. per C. and retailed it at $3\frac{1}{4}d.$ per lb. what is gained in the whole?

C. s. C. £. s.
If 1 . . 28 : : 18 . . 25 4 Prime cost.
18 C. = 2016 lb. at $3\frac{1}{4}d.$ = 29l. 8s. sold for.
29l. 8s. — 25l. 4s. = 4l. 4s. *Ans.*

2. Bought knives at 20d. each, and sold them at 17d. each, now much is lost by the sale of 120 dozen? *Ans.* 18l.

3. Hats bought at 52 cts. a piece, and sold at 65 cts. what is the gain per cent.? *Ans.* 25 dol.

4. Bought 7 tuns of wine, at 45 dol. 33 cts. per hhd. and sold it at 14 cts. per pint; what is the whole gain, and the gain per cent.?

Ans. Whole gain 706dol. 44cts. per cent. 55dol. 65cts. 8m. +

5. A draper bought 100 yards of cloth for 56 dol. how must he sell it per yard to gain 19 dol. in the whole?

Ans. 75 cts per yard.

6. Bought 60 reams of paper, at 75 cts. per ream; what is lost in the whole quantity, at 4 per cent.? *Ans.* 1 dol. 80 cts.

7. Sold 500 penknives, at 17 cts. a piece, at 9 per cent. loss; what is lost on the whole number? *Ans.* 8 dol. 40 cts. +

8. Paid 184 dol. for one ton of steel; what is the profit or loss on the sale of 14 ton, retailed at 7 cts. per lb.?

Ans. 380 dol. 80 cts. loss.

9. If a yard of cloth be bought for 13s. 4d. and sold for 16s. what is the gain per cent.?

Ans. 20%.

10. If 1 Cwt. of tobacco be bought for 12 dol. 44 cts. and sold at 12½ cents per lb. what is the gain or loss per cent.?

Ans. 12 dol. 54 cts. gain.

11. A draper bought 100 yards of cloth for 134 dol. 40 cts. how must he sell it per yard, to gain 15 per cent.?

Ans. 1 dol. 54 cents 5.6m.

12. Sold 12 yards of cloth for 15 dol. 20 cts. by which was gained 8 per cent. what was the prime cost of a yard?

Ans. 1 dol. 17 cts. 2.8m. +

13. Having bought a parcel of goods for 49 dol. 20 cts. and sold the same immediately for 60 dol. with 4 months credit; what is gained per cent. per annum?

Ans. 116 dol. 66 cts. 6m. +

14. Bought 300 lb. of coffee at 56 cts. per lb. ready money, and sold it at 67 cts. per lb. payable in 8 months; how much was gained on the whole, allowing discount at 6 per cent. and how much per cent.?

Ans. { 25 dol. 27 cts. whole gain nearly.
15 dol. per cent.

15. If, when cloth is sold for 84 cts. per yard, there is gained 10 per cent. what will be the gain per cent. when it is sold for 1 dol. 2 cts. per yard?

Ans. 33 dol. 57 cts. +

16. Bought a chest of tea, weighing 490 lb. for 122l. 10s. and sold it for 138l. 16s. 8d. what was the profit on each lb.?

Ans. 8d.

17. Bought 12 pieces of white cloth, for 16 dol. 50 cts. per piece, paid 2 dol. 87 cts. a piece for dying; for how much must I sell them each, to gain 20 per cent.?

Ans. 23 dol. 24 cts. 4m.

18. If 28 pieces of stuff be purchased at 9 dol. 60 cts. per piece, and 10 of them sold at 14 dol. 40 cts. and 8 at 12 dol. per piece; at what rate must the rest be disposed of, to gain 10 per cent. by the whole?

Ans. 5 dol. 56 cts. 8m.

19. Sold a yard of cloth for 1 dol. 55 cts. by which was gained at the rate of 15 per cent. but if it had been sold for 1 dol. 72 cts. what would have been the gain per cent.?

Ans. 27 dol. 61 cts. 2m. +

20. If, when cloth is sold at 93 cts. 5m. a yard, the gain is 10 dol. per cent. what is the gain or loss per cent. when it is sold at 80 cts. a yard?

Ans. 5 dol. 88 cts. + loss.

21. At 9 cts. 5m. per dollar profit, how much per cent. ?

Ans. 9 dol. 50 cts.

22. At 3s. 6d. in the pound profit, how much per cent. ?

Ans. 17l. 10s.

23. If by selling 1 lb. of pepper for 10 cts. 5m, there is 2 cts. lost, how much is the loss per cent. ?

Ans. 16 dol.

24. A merchant receives from Lisbon 180 casks of raisins, which stand him here in 2 dol. 13 cents each; and by selling them at 3 dol. 68 cts. per Cwt. he gains 25 per cent.; required the weight of each cask, one with another.

Ans. 81 lb. nearly,

FELLOWSHIP.

FELLOWSHIP is the rule for adjusting the several quotas of the loss or gain of any joint adventure, or of a bankrupt's effects, &c.

CASE 1.

When the several stocks in company are considered without regard to time;

RULE.

As the whole sum, or stock,
Is to the whole gain, or loss;
So is each partner's share in stock, &c.
To his quota of the gain or loss.

PROOF.

The sum of the several shares, must be equal to the whole gain or loss.

EXAMPLES.

1. Three merchants traded: A put in 140l. B. 300l. and C 160l.; their gain was 120l.; what is each man's share thereof?

A 140

B 300

C 160

As 600 .. 120 :: $\left\{ \begin{array}{l} 140 \dots 28 \text{ A's share,} \\ 300 \dots 60 \text{ B's share,} \\ 160 \dots 32 \text{ C's share,} \end{array} \right\}$ *Ans.*

£. 600

120 Proof.

2. Three merchants trading to Virginia, lost goods to the value of 1920 dol.; now suppose A's stock was 2880 dol. B's 11520 dol. C's 4800 dol. what sum must each man sustain of the loss? *Ans.* A 288 dol. B 1152 dol. and C 480 dol.

3. A, B, C, freighted a ship with 108 tuns of wine, of which A had 48 tuns, B 36, and C 24, but by reason of stormy weather, were obliged to cast 45 tuns overboard; how much must each man sustain of the loss? *Ans.* A 20, B 15, and C 10 T.

4. Suppose a merchant is indebted to S 168 dol. T 960 dol. V 337 dol. 50 cts. but upon his death his estate is found to be worth only 983 dol. 28 cts. how must it be divided among his creditors?

Ans. S must have 112.7199 dol. T 644.1138 dol. V 226.446 dol.

5. If the money and effects of a bankrupt amount to 3361.74 dol. and he is indebted to A 1782.24 dol. to B 1540.76 dol. and to C 2371.17 dol. how must it be divided amongst them?

Ans. A 1052.2038 dol. B 909.63 dol. 8.1m. C 1399.8979 dol.

6. Three graziers, A, B, and C, rent an estate, containing 292 acres, 3 roods, 17 perches, at 480 dol. per annum; of which A pays 144 dol. B 156 dol. C 180 dol. they have agreed that the estate shall be divided in proportion to their rents; what is each man's dividend?

	A.	R.	P.
<i>Ans.</i> { A's share,	87	3	17
{ B's	95	0	28
{ C's	109	3	11

7. P, Q, and R, rent an estate, containing 360 acres, at 240l. per annum; of which P holds 90, Q 120, and R 150 acres: what must each man pay in proportion to the land he holds?

<i>Ans.</i> { P.	60l.
{ Q.	80l.
{ R.	100l.

CASE 2.

When the respective stocks in company are considered with time;

RULE.

Multiply each man's stock by its time; then

As the sum of the products,

Is to the whole gain or loss;

So is each particular product

To its share of the gain or loss.

EXAMPLES.

1. Three merchants traded together: A put in 120*l*. for 9 months, B 100*l*. for 16 months, C 100*l*. for 14 months, and they gained 100*l*. what is each man's quota?

	<i>l</i> .	<i>m</i> .
A	120	9
B	100	16
C	100	14

	Sum	4080	Sum	£.	s.	d.	gr.	
Sum.	£.	{	1080	..	26	9	4	3 $\frac{11}{1000}$ A's
As 4080	.. 100	{	1600	..	39	4	3	3 $\frac{24}{1000}$ B's
		{	1400	..	34	6	3	1 $\frac{12}{1000}$ C's

Ans.

100 0 0 0 Proof.

2. Three merchants in a joint adventure, put in as follows: A 960 dol. for 9 months, B 1632 dol. for 5 months, and C 288 dol. for 12 months; but by misfortune, lost goods to the value of 1200 dol. what must each sustain of the loss?

Ans. A must lose 511.8483 dol. B 483.41 dol. C 204.7393 dol.

3. A, B, and C, hold a pasture in common, for which they pay 20*l*. per annum; in this pasture A had 40 oxen for 76 days, B 36 for 50 days, and C 50 for 90 days; what part of the 20*l*. must each of them pay?

Ans. A must pay 6*l*. 10*s*. 2½*d*. B 3*l*. 17*s*. 1*d*. C 9*l*. 12*s*. 8½*d*.

4. A puts in stock 432 dol. B advanced 4 months after; required the sum he put in, so as at the year's end to claim equal profit with A: *Ans.* 648 dol.

5. A, B, and C join stock for 12 months; A puts in on the first of the first month 240 dol. and the first of the fifth month 360 dol. more, and on the first of the ninth month takes out 72 dol. B puts in the first of the first month 600 dol. on the first of the sixth month 144 dol. more, and on the first of the eleventh month 240 dol. more. C puts in the first of the first month 720 dol. and on the first of the fourth month takes out 480 dol. on the first of the eighth month takes out 120 dol. more; and at the end of the year they found their whole gain to be 319 dols. 20 cts. What is each partner's share thereof?

Ans. A 97.6881, B 155.1, C 66.41 dollars.

6. A, B, and C made a stock for 12 months; A put in at first 873.6 dol. and 4 months after he put in 96 dol. more; B put in at first 979.2 dol. and at the end of 7 months he took out 206.4 dol.; C put in at first 355.2 dol. and three months after he put in 206.4 dol. and 5 months after that he put in

240 dol. more; and at the end of 12 months, their gain is found to be 3446.4 dol.; what is each man's share thereof?

Ans. A 1334.825 dol. B 1271.6145 dol. C 839.96 dol.

7. A, B, and C, join in company; A's stock is 100 dbl. for 12 months, B's 120 yards of cloth for 8 months, and C's 240 bushels of wheat for 7 months; they gained 1612 dollars, of which A had 400 dol. B 512 dol. and C 700 dol. What was the value of B's cloth per yard, and C's wheat per bushel?

Ans. B's cloth 1 dol. 60 cts. per yard.

C's wheat 1 dol. 25 cts. per bushel.

EXCHANGE.

EXCHANGE is the rule by which the money, &c. of one state or country, is reduced to that of another.

Par is equality in value; but the course of exchange is frequently above or below par.

Agio is a term used to signify the difference in some countries, between bank and current money.

Accounts are kept in England, Ireland, and the West India Islands, in pounds, shillings, pence, and farthings; though their intrinsic values in these places are different.

A TABLE OF DIFFERENT MONIES.

FRANCE.

12 deniers	.	.	.	= 1 sol,
20 sols	.	.	:	= 1 livre,
6 livres	.	.	.	= 1 crown.

SPAIN.

4 marvadies vellon, or	}	= 1 quarta,
2½ marvadies of plate	}	
8½ quartas, or	}	= 1 rial vellon,
34 marvadies vellon	}	
16 quartas, or	}	= 1 rial of plate,
34 marvadies of plate	}	
8 rials of plate	.	= 1 piastre, pezo, or dollar,
5 piastres	.	= 1 Spanish pistole,
2 Spanish pistoles	.	= 1 doubloon.

ITALY.

12 deniers	-	-	= 1 sol,
20 sols	-	-	= 1 livre,
5 livres	-	-	= 1 piece of eight at Genoa,
6 livres	-	-	= 1 do. at Leghorn,
6 solidi	-	-	= 1 gross,
24 grosses	-	-	= 1 ducat.

PORTUGAL.

400 reas	-	-	= 1 crusadoe,
1000 reas	-	-	= 1 millrea.

HOLLAND.

8 pennings	-	-	= 1 groat,
2 groats	-	-	= 1 stiver = 2d.
6 stivers	-	-	= 1 shilling,
20 stivers	-	-	= 1 florin, or guilder,
2½ florins	-	-	= 1 rix dollar,
6 florins	-	-	= 1 £. Flemish,
5 guilders	-	-	= 1 ducat.

DENMARK.

16 shillings	-	-	= 1 mark,
6 marks	-	-	= 1 rix dollar,
32 rustics	-	-	= 1 copper dollar,
6 copper dollars	-	-	= 1 rix dollar.

RUSSIA.

18 pennins	-	-	= 1 gross,
30 gross	-	-	= 1 florin,
3 florins	-	-	= 1 rix dollar,
2 rix dollars	-	-	= 1 gold ducat.

RULE.

The various operations, in the exchanging of monies, are performed by the Single Rule of Three; or by Practice.

Note. The par of exchange between the United States of America, and most other trading countries, may be ascertained by the tables in page 14.

EXAMPLES.

1. Philadelphia is indebted to London 1474 dollars, 80 cents currency; what sterling sum must be remitted, when the exchange is at par?

$$\begin{array}{r}
 \text{Dol.} \quad \text{£.} \quad \text{Dol.} \\
 \hline
 \text{£ } 4.44 \dots 1 :: 1474.80 \\
 \hline
 1.11 \quad 1.11) 368.70 (332.16 = \text{£ } 332 \text{ } 3 \text{ } 2\frac{1}{4} + \text{Ans.} \\
 \quad \quad \quad 3548 \\
 \quad \quad \quad 2160 \\
 \quad \quad \quad \quad 90 \\
 \hline
 \quad \quad \quad 24
 \end{array}$$

2. London receives a bill of exchange from Philadelphia for 943*l.* 17*s.* sterling: for how much currency was it drawn, exchange being at 3.8 dollars per £. sterling?

Ans. 3586 dol. 63 cts.

3. Jamaica is indebted to London 1470*l.* 12*s.* 8*d.* sterling; with how much currency will London be credited at Jamaica, when the exchange is at 36½ per cent.?

Ans. 2007*l.* 8*s.* 3¼*d.*

4. Dublin draws upon London for 740*l.* 14*s.* 6*d.* Irish, exchange at 12 per cent. How much sterling will discharge this bill?

Ans. 661*l.* 7*s.* 2¾*d.*

5. London remits to Ireland 651*l.* 14*s.* 11¼*d.* sterling; how much Irish must London be credited with, exchange at 12 per cent.?

Ans. 729*l.* 19*s.* 2*d.*

6. Philadelphia, 20th, 2 mo. 1819.

Exchange for 452*l.* 10*s.* 6*d.* sterling.

Thirty days after sight of this my first of exchange, second and third of like tenor and date not paid, pay to Samuel Simms, or order, four hundred and fifty-two pounds, ten shillings and six-pence sterling, value received; and place the same to account as per advice from

Peter Simpson.

Samuel Pimm,
Merchant, London.

What is the value of this bill in the United States' currency, exchange at 4.84 dollars per £. sterling?

Ans. 2190 dol. 22 cts. 1 m.

7. In a settlement between C of Philadelphia, and D of London, C is indebted 750*l.* 2*s.* sterling; what sum United States' currency is equivalent, exchange at 4.56 dollars per £. sterling?

Ans. 3420 dol. 45 cts. 6m.

8. How much sterling is equal to 11341 dol. 90 cts. United States' currency, exchange at 3.75 dollars per £. sterling?

Ans. 3024*l.* 10*s.* + sterling.

9. What sum sterling will be equal to 1260 dol. 84 cts. United States' currency, exchange at 5.25 dol. per £. sterling?

Ans. 240*l.* 3*s.* 2½*d.* sterling.

10. Purchased in Ireland effects to the value of 400*l.* 17*s.* 9*d.* of that place; what sum United States' currency, will discharge the debt, exchange at 3.4 dollars per £. sterling?

Ans. 1363 dol. 1 ct. 7.5m.

11. Philadelphia, 2d 3mo. 1819.

Exchange for 4226 livres, 12 sols, 8 deniers.

Thirty days after sight of this my second of exchange, first of the same tenor and date not paid, pay to Thomas Broker, or order, four thousand two hundred and twenty-six livres, twelve sols, and eight deniers, value received; and place the same to account as per advice from

To Thomas Lamott,
Merchant, London.

Silas Stroud.

How much sterling is the above bill, at 10½*d.* per livre? and what sum in United States' currency, at 17 cts. 5m. per livre?

£. s. d.

Ans. { 184 18 3½ sterling.
739 dol. 66 cts. + currency.

12. A Connecticut merchant imported goods from France amounting per invoice to 49008 livres; how much currency of the United States, at 15 cts. per livre, will they amount to; and how much sterling will discharge the debt, exchange being at par?

Ans. 7351 dol. 20 cts. currency; 1655*l.* 13*s.* 6*d.* sterling

13. A merchant in Holland being desirous to turn 4376 florins currency into banco, the agio at 4 per cent. how many pounds Flemish banco must he receive?

Ans. 701*l.* 1 *fl.* 13 *sti.* 13 *pen.*

14. P of Philadelphia, receives of A of Amsterdam, an invoice of goods amounting to 10235 *fl.* 17 *sti.* 8 *pen.* how much United States' currency must be remitted to discharge the bill at 35 cts. per florin? and what is the sum in sterling, exchange at 38*s.* 6*d.* Flemish per £. sterling?

Ans. { 3582 dol. 55 cts. 6.25m. currency
886*l.* 4*s.* 5½*d.* sterling.

15. A bill for 2524 pezos, 7 *ria.* 33 *marv.* being remitted to Cadiz; what sum United States' currency is equal thereto, at 1 dol. per pezo?

Ans. 2524 dol. 99 cts. 6.3m. +

16. A Virginian merchant sent goods to Norway worth 2743 dol. 80 cts. currency; how many rix dollars, at 80 cts. each must he receive? *Ans.* 3429.75 rix dol.

17. A merchant of North-Carolina shipped a quantity of flour, which when disposed of, amounted to 1186 millreas, 500 reas; and received in return 17 pipes of wine; what was it per pipe, a millrea reckoned at 1 dol?

Ans. 69 dol. 79 cts. +

18. In 2714 guilders, 15 stivers, how many pounds sterling, exchange at 35s. 6d. Flemish per £. sterling?

Ans. 254l. 18s. 1½d.

19. In 290l. 11s. 10d. sterling how many pounds Flemish, exchange at 33s. 10d. Flemish per £. sterling, and agio at 4½ per cent.?

Ans. 513l. 14s. 1d.

20. London is indebted to Genoa in 1710l. 16s. 4d. for how many pezos may Genoa draw on London, the exchange at 47½d. per pezo?

Ans. 8644 +

21. How many millreas will 1566l. 6s. 8d. amount to, exchange at 64d. per millrea?

Ans. 5873 millreas, 750 reas.

22. A merchant in Rotterdam remits 564l. 10s. 6d. Flemish to be paid in London; how much sterling money must he draw for, exchange at 34s. 4d. per £. sterling?

Ans. 328l. 16s. 11½d.

23. Amsterdam changes on London 34s. 3d. per £. sterling; and on Lisbon, at 52d. Flemish for 400 reas; how then ought the exchange to go between London and Lisbon?

Ans. 75½d. sterling, nearly, per millrea.

24. A, at Paris, draws on B, of London, for 1200 crowns at 55d. sterling per crown; for the value whereof, B draws again on A at 56d. sterling per crown, besides commission ½ per cent. what did A gain or lose by this transaction?

Ans. A gained 15½ + crowns.

VULGAR FRACTIONS.

A VULGAR Fraction is a part, or parts of an integer, and is noted thus, $\frac{1}{8}$ one eight; $\frac{7}{8}$ seven eights. The upper number is called the numerator, and shows the part or parts expressed by the fraction; the lower number is called the denominator, and denotes the number of such parts contained in an unit.

Vulgar Fractions are either proper, improper, compound or mixt.

A **proper Fraction** is one of which the numerator is less than the denominator; thus, $\frac{7}{8}$, $\frac{1}{12}$.

An **improper Fraction** is one of which the numerator is equal to, or greater than the denominator; thus, $\frac{8}{8}$, $\frac{9}{8}$.

A **Compound Fraction** is a fraction of a fraction, as $\frac{2}{3}$ of $\frac{3}{4}$ of $\frac{1}{2}$, &c.

A **mixt Number** consists of a whole number and a fraction; as $7\frac{1}{2}$.

A **mixt fraction** has a fraction annexed either to its numerator or denominator; as $\frac{7}{12}\frac{1}{3}$ or $\frac{7\frac{1}{3}}{12}$.

REDUCTION OF VULGAR FRACTIONS.

CASE I.

To reduce a fraction to its lowest terms;

RULE.

Divide the greater term by the less, and that divisor by the remainder, till nothing be left; the last divisor will be the common measure; by which divide both terms, for the fraction required: or,

Take the aliquot parts of both terms continually, till in their lowest terms:

Note. If the common measure be 1, the fraction is already in its lowest terms. Cyphers to the right hand of both terms may be rejected; thus, $\frac{7000}{1000} = \frac{7}{1}$.

EXAMPLES.

1. Reduce $\frac{48}{56}$ to its lowest terms;

Or,

$$\begin{array}{r} 2) \quad 4) \\ 48 = 12 \quad 4 = 4 \quad \text{Facit.} \end{array}$$

$$\begin{array}{r} 48 \overline{) 56} (1 \\ \underline{48} \end{array}$$

$$8)12=4$$

$$\begin{array}{r} \text{Com. measure } 8 \overline{) 48} (6 \\ \underline{48} \\ 0 \end{array}$$

- | | |
|--|---------------------|
| 2. Reduce $\frac{3}{4}$ to its lowest terms, | Facit $\frac{3}{4}$ |
| 3. Reduce $\frac{11}{12}$ to its lowest terms, | $\frac{11}{12}$ |
| 4. Reduce $\frac{13}{14}$ to its lowest terms, | $\frac{13}{14}$ |
| 5. Reduce $\frac{1}{3}$ to its lowest terms, | $\frac{1}{3}$ |
| 6. Reduce $\frac{217}{114}$ to its lowest terms, | $\frac{1}{3}$ |

CASE 2.

To reduce several fractions to others retaining the same value, and to have one common denominator;

RULE.

Reduce the given fractions to their lowest terms; then multiply each numerator into all the denominators but its own, for its respective numerator; and all the denominators into each other, for a common denominator.

Note. This Case, and Case 1, prove each other.

EXAMPLES.

1. Reduce $\frac{7}{8}$, $\frac{9}{10}$, and $\frac{11}{12}$ to a common denominator.

$$\begin{array}{l} 7 \times 10 \times 12 = 840 \\ 9 \times 8 \times 12 = 864 \\ 11 \times 8 \times 10 = 880 \end{array} \left. \begin{array}{l} \\ \\ \end{array} \right\} \text{Numerator.}$$

$$8 \times 10 \times 12 = 960 \text{ Denominator. Facit, } \frac{840}{960}, \frac{864}{960}, \text{ and } \frac{880}{960}.$$

2. Reduce $\frac{1}{8}$, $\frac{2}{3}$, $\frac{1}{2}$, and $\frac{3}{4}$ to a common denominator.

$$\text{Facit, } \frac{120}{960}, \frac{640}{960}, \frac{480}{960}, \text{ and } \frac{720}{960}.$$

3. Reduce $\frac{1}{8}$, $\frac{1}{12}$, $\frac{2}{3}$, and $\frac{1}{2}$ to a common denominator.

$$\text{Facit, } \frac{120}{960}, \frac{80}{960}, \frac{640}{960}, \text{ and } \frac{480}{960}.$$

4. Reduce $\frac{2}{3}$, $\frac{1}{2}$, and $\frac{1}{4}$ to a common denominator.

$$\text{Facit, } \frac{400}{960}, \frac{480}{960}, \text{ and } \frac{240}{960}.$$

5. Reduce $\frac{1}{2}$, $\frac{1}{3}$, $\frac{2}{3}$ and $\frac{3}{4}$ to a common denominator.

$$\text{Facit, } \frac{480}{960}, \frac{320}{960}, \frac{640}{960} \text{ and } \frac{720}{960}.$$

CASE 3.

To reduce a mixt number to an improper fraction;

RULE.

To the product of the whole number with the denominator, add the numerator, for a new numerator; under which, place the given denominator.

EXAMPLES.

1. Reduce $12\frac{1}{4}$ to an improper fraction.

$$12 \times 4 + 1 = 49 \text{ Facit, } \frac{49}{4}$$

2. Reduce $19\frac{1}{4}$ to an improper fraction.

$$\text{Facit } \frac{77}{4}$$

3. Reduce $16\frac{1}{2}$ to an improper fraction.
4. Reduce $100\frac{1}{2}$ to an improper fraction.
5. Reduce $514\frac{1}{2}$ to an improper fraction.
6. Reduce $47\frac{1}{2}$ to an improper fraction.

Facit $1\frac{1}{2}$.
 $5\frac{1}{2}$.
 $8\frac{1}{2}$.
 $3\frac{1}{2}$.

CASE 4.

To reduce an improper fraction to a whole or mixt number.

RULE.

Divide the upper term by the lower.

Note. This Case, and Case 3, prove each other.

EXAMPLES.

1. Reduce $2\frac{1}{2}$ to its proper terms.

17)219(12 $\frac{1}{2}$ Facit.

17

49

34

15

2. Reduce $1\frac{1}{2}$ to its proper terms.

Facit $8\frac{1}{2}$.

3. Reduce $1\frac{1}{2}$ to its proper terms.

2 $\frac{1}{2}$.

4. Reduce $2\frac{1}{2}$ to its proper terms.

56 $\frac{1}{2}$.

5. Reduce $1\frac{1}{2}$ to its proper terms.

1 $\frac{1}{2}$.

6. Reduce $3\frac{1}{2}$ to its proper terms.

183.

CASE 5.

To reduce a compound fraction to a single one;

RULE.

Multiply all the numerators together for a new numerator, and all the denominators for a new denominator.

Note. Like figures in the numerators and denominators may be cancelled, and frequently others contracted, by taking their aliquot parts.

EXAMPLES.

1. Reduce $\frac{2}{3}$ of $\frac{3}{4}$ of $\frac{4}{5}$ to a single fraction.

$$\begin{array}{l} 2 \times 3 \times 4 = 24 \\ 3 \times 4 \times 5 = 60 \end{array} \left. \vphantom{\begin{array}{l} 24 \\ 60 \end{array}} \right\} \text{Facit, Or, } \frac{2}{3} \text{ of } \frac{3}{4} \text{ of } \frac{4}{5} = \frac{24}{60} = \frac{2}{5}.$$

Or cancelled, 2 of 3 of 4 2 as before.

$$\frac{2}{3} \quad \frac{3}{4} \quad \frac{4}{5} \quad \frac{2}{5}$$

2. Reduce $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{3}{4}$ to a single fraction. Facit $\frac{1}{4}$.
3. Reduce $\frac{2}{3}$ of $\frac{3}{4}$ of $\frac{4}{5}$ to a single fraction. Facit $\frac{2}{5}$.
4. Reduce $\frac{3}{4}$ of $\frac{4}{5}$ of $\frac{5}{6}$ to a single fraction. Facit $\frac{1}{2}$.
5. Reduce $\frac{4}{5}$ of $\frac{5}{6}$ of $\frac{6}{7}$ to a single fraction. Facit $\frac{4}{7}$.
6. Reduce $\frac{5}{6}$ of $\frac{6}{7}$ of $\frac{7}{8}$ to a single fraction. Facit $\frac{5}{8}$.

CASE 6.

To reduce the fraction of one denomination to the fraction of another, but greater, retaining the same value;

RULE.

Make it a compound fraction, by comparing it with all the denominations between it and that to which it is to be reduced; which fraction reduce to a single one.

EXAMPLES.

1. Reduce $\frac{1}{2}$ of a penny to the fraction of a pound.
 $\frac{1}{2}$ of $\frac{1}{12}$ of $\frac{1}{20} = \frac{1}{240} = \frac{1}{240} \text{ } \mathcal{L}$. Facit.
2. Reduce $\frac{1}{4}$ of a farthing to the fraction of a shilling.
 Facit $\frac{1}{160} \text{ } s$.
3. Reduce $\frac{1}{2}$ of an ounce troy, to the fraction of a lb.
 Facit $\frac{1}{16} \text{ } lb$.
4. Reduce $\frac{1}{2}$ of a lb. avoirdupois, to the fraction of an Cwt.
 Facit $\frac{1}{20} \text{ } Cwt$.
5. Reduce $\frac{1}{2}$ of a pint of wine to the fraction of a hhd.
 Facit $\frac{1}{16} \text{ } hhd$.
6. Reduce $\frac{1}{4}$ of a minute to the fraction of a day.
 Facit $\frac{1}{1440} \text{ } day$.

CASE 7.

To reduce the fraction of one denomination to the fraction of another, but less, retaining the same value;

RULE.

Multiply the given numerator by the parts of the denomination between it and that to which it is to be reduced, for a new numerator, and place it over the given denominator; which reduce to its lowest terms.

Note. This case and case sixth prove each other.

EXAMPLES.

1. Reduce $\frac{1}{240}$ of a pound to the fraction of a penny.
 $5 \times 20 \times 12 = 1240 = \frac{1}{1240} = \frac{1}{1240} \text{ } d$. Facit.
2. Reduce $\frac{1}{160}$ of a shilling to the fraction of a farthing.
 Facit $\frac{1}{160} \text{ } q$.
3. Reduce $\frac{1}{16}$ of a pound troy, to the fraction of an ounce.
 Facit $\frac{1}{16} \text{ } oz$.
4. Reduce $\frac{1}{20}$ of an Cwt. to the fraction of a lb.
 Facit $\frac{1}{20} \text{ } lb$.

5. Reduce $\frac{1}{11}$ of a hhd. to the fraction of a pint.

Facit $\frac{1}{11}$ pt.

6. Reduce $\frac{1}{11}$ of a day to the fraction of a minute.

Facit $\frac{1}{11}$ min.

CASE 8.

To reduce the value or quantity of a fraction to the known parts of an integer;

RULE.

Multiply the numerator by the common parts of the integer and divide by the denominator.

EXAMPLES.

1. Reduce $\frac{1}{3}$ of a pound to its proper value.

$\frac{1}{3}$ of $20 = \frac{20}{3} = 13s. 4d.$ Facit:

2. Reduce $\frac{1}{3}$ of a shilling to its value.

Facit $5\frac{1}{3}d.$

3. Reduce $\frac{1}{4}$ of 12.28 dol. to its value.

Facit 10.524 dols.

4. Reduce $\frac{1}{8}$ of a lb. troy to its value.

9 oz.

5. Reduce $\frac{1}{11}$ of 10 C. 1 qr. 12 lb. to its value.

Facit 8 C. 1 qr. 25 lb. 1 oz. $7\frac{1}{11}$ dr.

6. Reduce $\frac{1}{4}$ of a mile to its value.

Facit 4 fur. 125 yd. 2 f. 1n. $2\frac{1}{4}$ b.c.

7. Reduce $\frac{1}{4}$ of an ell English to its value.

Facit 1 yd.

8. What is the value of $\frac{1}{4}$ of a yard?

Ans. 3 qr. $1\frac{1}{4}$ na.

9. What is the value of $\frac{1}{4}$ of an acre?

1 R. $2\frac{1}{4}$ pls.

10. What is the value of $\frac{1}{4}$ of a day?

7 h. 12 min.

11. What is the value of $\frac{1}{4}$ of a dollar?

12 cts. 5 m.

12. What is the value of $\frac{1}{4}$ of a French crown?

Ans. 9.1666 cts. +

13. What is the value sterling of $\frac{1}{4}$ of an English guinea; and what in United States currency?

Ans. 4s. 8d. sterling, 1 dol. 3 cts. 7 m. United States currency.

14. What is the value sterling of $\frac{1}{4}$ of a moidore; and what in United States currency?

Ans. 1l. 1s. $7\frac{1}{4}$ d. sterling, 4 dol. 80 cts. currency.

CASE 9.

To reduce any given value, or quantity, to the fraction of any greater denomination of the same kind;

RULE.

Reduce the given quantity to its lowest term mentioned, for a numerator; and the integer into the same name, for a denominator; which reduce to their lowest terms.

Note 1. If a fraction be given, multiply both parts by the denominator thereof, and to the numerator, add the numerator of the given fraction.

2. Case 8 and 9 prove each other.

EXAMPLES.

1. Reduce 13s. 4d. to the fraction of a pound.

s. d.

$$\frac{13 \text{ s. } 4 \text{ d.}}{20} = \frac{13 \times 12 + 4}{20} = \frac{156 + 4}{20} = \frac{160}{20} = 8 \text{ s. } \left. \begin{array}{l} \\ \end{array} \right\} \text{Facit.}$$

2. Reduce $5\frac{1}{3}$ d. to the fraction of a shilling.

Facit $1\frac{1}{3}$ s.

3. Reduce 9 oz. troy to the fraction of a lb.

Facit $\frac{3}{4}$ lb.

4. What part of 3l. 9s. is 4l. 13s. 5d.?

Ans. $\frac{1}{3}$

5. Reduce 3 C. 8 lb. 9 oz. $13\frac{1}{3}$ dr. to the fraction of a ton

Facit $\frac{2}{3}$ ton

6. Reduce 2 f. 8 in. $1\frac{1}{2}$ b.c. to the fraction of a yard.

Facit $\frac{9}{16}$ yd

7. Reduce 1 yd. to the fraction of an ell English.

Facit $\frac{1}{4}$ ell

8. Reduce 3 qr. 2 na. to the fraction of a yard.

Facit $\frac{1}{4}$ yd

9. Reduce 1 R. 30 per. to the fraction of an acre.

Facit $\frac{1}{16}$ acre

10. Reduce 13 h. 30 min. to the fraction of a day.

Facit $\frac{1}{2}$ day

CASE 10.

To reduce fractions from one denomination to another of the same value, having the numerator of the required fraction given.

RULE.

As the numerator of the given fraction,

Is to the denominator,

So is the numerator of the intended fraction,

To its denominator.

Note. As the tenth, eleventh, and twelfth cases are seldom useful, they may be taught or omitted, at the option of the teacher.

EXAMPLES.

1. Reduce $\frac{1}{3}$ to a fraction of the same value, whose numerator shall be fifteen.

$$\text{As } 3 \dots 4 :: 15 \dots 20 \text{ Facit } \frac{1}{3} = \frac{5}{15}$$

2. Reduce $\frac{1}{2}$ to a fraction of the same value, the numerator of which shall be 42. Facit $\frac{21}{42}$

3. Reduce $\frac{1}{3}$ to a fraction of the same value, the numerator of which shall be 34. Facit $\frac{11}{34}$

4. Reduce $\frac{1}{4}$ to a fraction of the same value, the numerator of which shall be 73. Facit $\frac{18}{73}$

CASE 11.

To reduce fractions from one denomination to another of the same value, having the denominator of the required fraction given.

RULE.

As the denominator of the given fraction,
Is to its numerator;
So is the denominator of the intended fraction,
To its numerator.

Note. Case 10 and 11 prove each other.

EXAMPLES.

1. Reduce $\frac{1}{2}$ to a fraction of the same value, whose denominator shall be 20.

As 4 . . . 3 :: 20 . . . 15 Facit $\frac{15}{20} = \frac{3}{4}$

2. Reduce $\frac{1}{3}$ to a fraction of the same value, the denominator of which shall be 49. Facit $\frac{16}{49}$

3. Reduce $\frac{1}{4}$ to a fraction of the same value, the denominator of which shall be 46. Facit $\frac{11}{46}$

4. Reduce $\frac{1}{5}$ to a fraction of the same value, the denominator of which shall be 131. Facit $\frac{26}{131}$

CASE 12.

To reduce a mixt fraction to a simple one;

RULE.

Multiply each term of the principal fraction by the denominator of that annexed, for the like term of the simple fraction, adding the annexed numerator to the product of the term to which it belongs.

EXAMPLES.

1. Reduce $4\frac{7}{8}$ to a simple fraction.

$$\begin{array}{rcl} 42 \times 8 + 7 = 343 & & \\ 49 \times 8 = 392 & & \\ \hline & & = 7 \text{ Facit.} \end{array}$$

2. Reduce
- $1\frac{1}{3}$
- to a simple fraction.

$$\begin{array}{r} 73 \times 5 = 365 \\ 131 \times 5 + 2 = 657 \end{array} \left. \vphantom{\begin{array}{r} 73 \times 5 \\ 131 \times 5 \end{array}} \right\} = \frac{365}{657} \text{ Facit.}$$

3. Reduce
- $\frac{3}{4}$
- to a simple fraction.

Facit $\frac{3}{4}$

4. Reduce
- $\frac{3}{4}$
- to a simple fraction.

 $\frac{3}{4}$

5. Reduce
- $1\frac{1}{2}$
- to a simple fraction.

 $\frac{3}{2}$

6. Reduce
- $1\frac{1}{2}$
- to a simple fraction.

 $\frac{3}{2}$ **ADDITION OF VULGAR FRACTIONS.****RULE.**

REDUCE the given fraction, if necessary, to simple fractions, and to a common denominator, (omitting integers;) place the sum of the numerators over the common denominator; then to the value of said fractions, add the integers, (if any.)

If fractions be of different integers, find their value separately, and add as in compound addition.

EXAMPLES.

1. Add
- $\frac{1}{2}$
- and
- $\frac{1}{2}$
- together.

$$\frac{1}{2} + \frac{1}{2} = \frac{1}{2} + \frac{1}{2} = \frac{2}{2} = 1 \text{ Facit.}$$

2. Add
- $\frac{7}{10}$
- ,
- $\frac{1}{10}$
- and
- $\frac{1}{10}$
- together.

Facit $2\frac{1}{10}$

3. Add 19, 7, and
- $\frac{1}{2}$
- of
- $\frac{2}{3}$
- together.

26 $\frac{1}{2}$

4. Add
- $\frac{2}{3}$
- of
- $\frac{1}{2}$
- , and
- $\frac{1}{3}$
- of
- $\frac{1}{2}$
- together.

 $1\frac{1}{2}$

5. Add
- $\frac{1}{2}$
- of 95, and
- $\frac{1}{2}$
- of 14 together.

43 $\frac{1}{2}$

6. Add
- $\frac{2}{3}$
- , and
- $17\frac{1}{2}$
- together.

18 $\frac{1}{2}$

7. Add
- $12\frac{1}{2}$
- ,
- $3\frac{3}{4}$
- , and
- $4\frac{1}{4}$
- together.

20 $\frac{1}{2}$

8. Add 6,
- $\frac{1}{2}$
- of
- $\frac{3}{4}$
- ,
- $\frac{1}{4}$
- of
- $\frac{1}{2}$
- , and
- $7\frac{1}{2}$
- together.

14 $\frac{1}{4}$

9. Add
- $\frac{2}{3}$
- ,
- $\frac{1}{3}$
- of
- $\frac{1}{2}$
- , and
- $9\frac{1}{2}$
- together.

10 $\frac{1}{2}$

10. Add
- $\frac{2}{3}$
- of a penny to
- $\frac{1}{3}$
- of a pound.

2s. 3d. $1\frac{1}{3}$ gr.

11. Add
- $\frac{1}{2}$
- of a pound to
- $\frac{1}{2}$
- of a shilling.

18s. 3d.

12. Add
- $\frac{1}{2}$
- of a lb. troy to
- $\frac{1}{2}$
- of an oz.

Facit 6 oz. 11 dwt. 16 gr.

13. Add
- $\frac{1}{2}$
- of a ton to
- $\frac{1}{2}$
- of an C.wt.

Facit 12 C. 1 qr. 8 lb. 12 oz. $12\frac{1}{2}$ dr.

14. Add
- $\frac{1}{2}$
- of a mile to
- $\frac{1}{2}$
- of a furlong.

Facit 6 fur. 28 pl.

15. Add $\frac{1}{2}$ of a yard to $\frac{2}{3}$ of a foot. Facit 2 ft. 2 in.
16. Add $\frac{1}{3}$ of a day to $\frac{1}{2}$ of an hour. Facit 8 hr. 30 min.
17. Add $\frac{1}{2}$ of a week, $\frac{1}{4}$ of a day, and $\frac{1}{2}$ of an hour together. Facit 2 da. 14 $\frac{1}{2}$ hours.
18. Add $\frac{2}{3}$ of a yard, $\frac{1}{4}$ of a foot, and $\frac{1}{8}$ of a mile together. Facit 1540 yd. 2 ft. 9 in.
19. What is the sum of $\frac{1}{4}$ of a £. $\frac{2}{3}$ of a shilling, and $\frac{1}{2}$ of a penny? Ans. 3s. 1d. 1 $\frac{1}{2}$ gr.
20. What is the sum of $\frac{2}{3}$ of 15 dol. $3\frac{2}{3}$ dol. $\frac{1}{2}$ of $\frac{1}{4}$ of $\frac{2}{3}$ of a dol. and $\frac{2}{3}$ of $\frac{2}{3}$ of a cent? Ans. 7 dol. 86 cts.
21. Add $\frac{2}{3}$ of 12 dol. + $4\frac{2}{3}$ dol. + $\frac{1}{2}$ of $\frac{1}{4}$ of a dol. + $\frac{2}{3}$ of $\frac{1}{4}$ of a cent, into one sum. Facit 9 dol. 41 cts. 3 $\frac{1}{2}$ m.
22. If a merchant own $\frac{2}{3}$ of a ship, valued at 3600 dol. and buys another person's share of her, which is $\frac{1}{6}$; what part belongs to him, and what is it worth? Ans. $\frac{1}{2}$, worth 2475 dol.

SUBTRACTION OF VULGAR FRACTIONS.

RULE.

PREPARE the fractions as in addition, and subtract the lower numerator from the upper, placing the difference, over the common denominator.

If the lower numerator be the greater, subtract it from the common denominator, adding in the upper numerator, and carry one to the unit's place of the integer.

If fractions be of different integers, find their values separately, subtract as in compound subtraction.

EXAMPLES.

1. From $1\frac{1}{2}$ take $\frac{2}{3}$.

$$1\frac{1}{2} - \frac{2}{3} = 1\frac{1}{2} - \frac{4}{6} = 1\frac{2}{6} = 1\frac{1}{3}$$
 Facit.
2. From $1\frac{1}{2}$ take $\frac{2}{3}$. Facit $1\frac{1}{3}$
3. From $96\frac{1}{2}$ take $14\frac{2}{3}$. 81 $\frac{1}{6}$
4. From 96 take $\frac{2}{3}$. 95 $\frac{2}{3}$
5. From $\frac{2}{3}$ of 76, take $\frac{1}{3}$ of 21. 9 $\frac{1}{3}$
6. From $1\frac{1}{2}$ take $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{2}{3}$. 1 $\frac{1}{3}$
7. From $71\frac{1}{2}$ take $1\frac{1}{3}$. 70 $\frac{2}{3}$
8. From $14\frac{1}{2}$ take $\frac{2}{3}$ of 19. 13 $\frac{1}{3}$

- 9 From $\frac{1}{2}$ of a £. take $\frac{3}{4}$ of a shilling. *Facit 9s. 3d.*
 10. From $\frac{1}{2}$ of a shilling, take $\frac{3}{4}$ of a penny. *5d.*
 11. From $\frac{3}{4}$ of an oz. troy, take $\frac{1}{4}$ of a dwt. *11 dwt. 9 gr.*
 12. From $\frac{1}{2}$ of an Cwt. take $\frac{7}{8}$ of a lb.
Facit 1 qr. 27 lb. 6 oz. 10 $\frac{1}{2}$ dr.
 13. From $\frac{3}{4}$ of a league, take $\frac{1}{8}$ of a mile.
Facit 1 m. 2 fur. 16 pbs.
 14. From 1 ell English, take $\frac{7}{8}$ of a quarter.
Facit 1 yd. 1 $\frac{1}{2}$
 15. From 7 weeks, take $9\frac{7}{8}$ days.
Facit 5 w. 4 da. 7 hr. 12 min.
 16. From 4 days, $7\frac{1}{2}$ hours, take 1 day, $9\frac{3}{4}$ hours.
Facit 2 da. 22 $\frac{1}{2}$ hr.
 17. Borrowed $5\frac{3}{4}$ £. paid $\frac{3}{4}$ of $4\frac{1}{2}$ £. what remains?
Ans. 4l. 3s. 8d. 1 $\frac{1}{2}$ gr.
 18. What is the difference between $\frac{1}{2}$ of a £. and $\frac{3}{4}$ of $\frac{3}{4}$ of a shilling?
Ans. 10s. 7d. 1 $\frac{1}{2}$ gr.
 19. Take $\frac{3}{4}$ of a shilling from $\frac{3}{4}$ of $5\frac{1}{2}$ £. and what is left?
Ans. 1l. 8s. 11 $\frac{3}{4}$ d.
 20. If a merchant own $\frac{1}{4}$ of a ship, valued at 2160 dol. and sells $\frac{3}{4}$ of his share; what part has he left, and what is it worth?
Ans. $\frac{1}{4}$, worth 450 dol.

MULTIPLICATION OF VULGAR FRACTIONS.

RULE.

If a compound fraction or mixt number be given, reduce them to single, or improper fractions; multiply the numerators together for a new numerator, and the denominators for a new denominator.

EXAMPLES.

1. Multiply $\frac{3}{4}$ by $\frac{3}{4}$
 $\frac{3}{4} \times \frac{3}{4} = \frac{9}{16}$ *Facit.*
 2. Multiply $\frac{1}{2}$ by $\frac{3}{4}$ *Facit $\frac{3}{8}$*
 3. Multiply $\frac{1}{2}$ of $\frac{3}{4}$ by $\frac{1}{8}$ of $\frac{1}{2}$ *$\frac{1}{16}$*
 4. Multiply $7\frac{1}{2}$ by $8\frac{1}{2}$ *61 $\frac{1}{4}$*
 5. Multiply $4\frac{1}{2}$ by $\frac{1}{2}$ *$\frac{9}{2}$*
 6. Multiply $\frac{3}{4}$ by $13\frac{3}{4}$ *12 $\frac{9}{8}$*
 7. Multiply $\frac{1}{2}$ of 7 by $\frac{3}{4}$ *$1\frac{3}{4}$*

8. Multiply $\frac{2}{3}$ of 8 by $\frac{1}{2}$ of 5. 21.
9. Multiply $\frac{2}{3}$ by $\frac{1}{2}$ of 11. $2\frac{1}{2}$
10. Multiply $\frac{1}{2}$ of 91 by $71\frac{1}{2}$. 5205 $\frac{1}{2}$
11. Multiply $12\frac{1}{2}$ by $\frac{1}{2}$ of 7. 29 $\frac{1}{2}$
12. Multiply $7\frac{1}{2}$ by $9\frac{1}{2}$. 69 $\frac{1}{4}$
13. What is the product of $\frac{2}{3}$ of $\frac{2}{3}$ and $\frac{1}{2}$ of $3\frac{1}{2}$? Ans. $\frac{1}{3}$
14. What is the product of $5 \times \frac{2}{3}, \times \frac{2}{3}$ of $\frac{2}{3}, \times 4\frac{1}{2}$? Ans. $2\frac{1}{3}$
15. What is the continued product of $\frac{2}{3}, 3\frac{1}{2}, 5$, and $\frac{2}{3}$ of $\frac{2}{3}$? Ans. $4\frac{1}{3}$
16. If $3\frac{1}{2}$ be multiplied by $\frac{1}{2}$, and this product again by $\frac{2}{3}$ of $\frac{2}{3}$, what is the last product? Ans. $\frac{3}{4}$

DIVISION OF VULGAR FRACTIONS.

RULE.

PREPARE the fractions, if necessary, as in multiplication; multiply the denominator of the divisor into the numerator of the dividend for a numerator; and the numerator of the divisor into the denominator of the dividend for a denominator.

EXAMPLES.

1. Divide $\frac{1}{17}$ by $\frac{2}{5}$

$$\begin{array}{r} 3 \overline{) 17 \times 5 = 85} \\ \underline{00} \\ 5 \overline{) 21 \times 3 = 63} \end{array}$$
85 ($1\frac{1}{2}$ Facit.
2. Divide $\frac{1}{3}$ by $\frac{1}{7}$ Facit $1\frac{1}{3}$
3. Divide $\frac{1}{12}$ by $\frac{1}{15}$ $1\frac{1}{4}$
4. Divide $1\frac{1}{2}$ by $4\frac{1}{2}$ $\frac{1}{3}$
5. Divide $\frac{1}{2}$ by 4 $\frac{1}{8}$
6. Divide 4 by $\frac{1}{2}$ 4 $\frac{1}{2}$
7. Divide $\frac{1}{2}$ of 19 by $\frac{1}{3}$ of $\frac{2}{3}$ 7 $\frac{1}{2}$
8. Divide $\frac{1}{2}$ of $\frac{2}{3}$ by $\frac{1}{3}$ of $\frac{2}{3}$ $\frac{1}{2}$
9. Divide $\frac{2}{3}$ of $\frac{2}{3}$ by $\frac{1}{2}$ of $\frac{2}{3}$ 1 $\frac{1}{2}$
10. Divide $4\frac{1}{2}$ by $\frac{1}{2}$ of 4 2 $\frac{1}{2}$
11. Divide $\frac{1}{2}$ of 4 by $4\frac{1}{2}$ $\frac{1}{9}$
12. Divide $\frac{1}{2}$ of 6, by $\frac{1}{3}$ of $\frac{2}{3}$ of $1\frac{1}{2}$ 8 $\frac{1}{3}$
13. What is the quotient of $7\frac{1}{2}$ divided by $9\frac{1}{2}$? Ans. $\frac{2}{3}$
14. What is the quotient of $\frac{2}{3}$ of $\frac{1}{2}$ divided by $\frac{1}{2}$ of $7\frac{1}{2}$? Ans. $1\frac{1}{3}$
15. What is the quotient of $5205\frac{1}{2}$ divided by $\frac{1}{2}$ of 91? Ans. $71\frac{1}{2}$

THE SINGLE RULE OF THREE IN VULGAR FRACTIONS.

DIRECT PROPORTION

RULE.

PREPARE the given terms, if necessary, by reduction, and state them as in whole numbers; multiply the second and third terms together, and divide that product by the first, —Or,

Invert the dividing term, and multiply the three together for the fractional answer.

Note 1. When the dividing term is inverted, the note to Case 5, in Reduction is applicable here.

2. When the fractional part will reduce to a decimal, without remainder, it will frequently facilitate the work to express those parts decimally.

EXAMPLES.

1. If $\frac{3}{4}$ of a yard cost $\frac{7}{8}$ £. what cost $\frac{5}{8}$ yd.?

As $\frac{3}{4} :: \frac{7}{8} :: \frac{5}{8} = \frac{35}{32} = 1\frac{3}{8} = 1\text{ s. } 4\text{ d. } \text{Ans.}$

Or cancelled;

$$\begin{array}{r} 5 \quad 7 \quad 3 = 1 \\ \hline 3 \quad 15 \quad 14 \quad 6\text{ s.} \end{array}$$

$$\frac{3 \times 7}{3 \times 2} = 3\text{ s. } 4\text{ d. } \text{Ans.}$$

$$\frac{3 \times 7}{3 \times 2} = 3\text{ s. } 4\text{ d. } \text{Ans.}$$

$$3 \times 2$$

2. If $1\frac{1}{2}$ lb. of sugar cost $\frac{7}{8}$ s. what cost $3\frac{1}{2}$ lb.?

Ans. 4d. 3qr. $\frac{1}{2}$ s.

3. If $\frac{1}{4}$ of an ell English cost $\frac{1}{8}$ dol. what is that per ell?

Ans. 94 s.

4. When 2oz. of silver cost $16\frac{1}{4}$ s. what is the value of $\frac{1}{2}$ oz.?

Ans. 6s. 1d. 3qr.

5. If 6 yds. cost 2.16 dol. what buys 9 yds.?

Ans. 3dol. 7 s. 6 cts.

6. Sold 500 bushels of wheat, at 56 cts. per bushel, what sum passes to the credit of that article?

Ans. 283dol.

7. If $1\frac{1}{2}$ yd. cost 1 dol. 8 cts. what is the value of 16 yds.?

Ans. 14 dol. 4 cts.

8. What sum pays for 100 yds. of cloth, at 2.06 dol. per yd.?

Ans. 206.4 dol.

9. At $5\frac{1}{2}$ s. per oz. what are $16\frac{1}{2}$ oz. of silver worth?
Ans. 4l. 12s. $1\frac{1}{2}$ gr.
10. If $\frac{1}{10}$ Cwt. cost $14\frac{1}{2}$ dol. what will $7\frac{1}{2}$ Cwt. amount to?
Ans. 118.33 $\frac{1}{2}$ dol.
11. If $\frac{2}{3}$ of an ell English be worth $\frac{1}{3}$ of 2.28 dol. what is the value of 7 ells?
Ans. 17.73 $\frac{1}{2}$ dol.
12. If 8 lb. of tobacco cost 4s. $9\frac{3}{4}$ d. what is that per lb.?
Ans. $7\frac{1}{4}$ d.
13. How much cash will purchase 4 pieces of cloth, each $27\frac{1}{2}$ yards, at $15\frac{1}{2}$ s. per yard?
Ans. 85l. 16s. $11\frac{1}{4}$ d.
14. Please to tell the quantity and value of $3\frac{1}{2}$ pieces of silk, each $24\frac{1}{2}$ yards, at 72 cents per yard?
Ans. quantity $85\frac{1}{2}$ yd. value 61.32 dol.
15. If $\frac{1}{2}$ lb. less by $\frac{1}{4}$, cost $13\frac{1}{2}$ d. what cost 14 lb. less by $\frac{1}{4}$ of 2 lb.?
Ans. 4l. 9s. $9\frac{3}{4}$ d.
16. Bought 120 lb. of tea, at $8\frac{1}{2}$ s. per lb. which being sold for 70l. required the gain per cent.
Ans. 35l. 5s. 3d. $3\frac{1}{2}$ gr.
17. What will $13\frac{3}{4}$ lb. cost, at the rate of $17\frac{1}{4}$ dol. per Cwt.?
Ans. 2 dol. $15\frac{1}{2}$ cts.
18. If $\frac{1}{4}$ of a ship be worth 175.35 dol. what part of her may be purchased for 601.2 dol.?
Ans. $\frac{3}{4}$.
19. If $3\frac{1}{2}$ times $3\frac{1}{2}$ lb. cost $1\frac{1}{2}$ times $1\frac{1}{2}$ l. what is the value of $\frac{1}{2}$ of $\frac{1}{3}$ of $12\frac{1}{4}$ lb.?
Ans. 7s. 6d.
20. A mercer sold $4\frac{3}{4}$ pieces of silk, each containing $22\frac{3}{4}$ yd. at $8\frac{3}{4}$ s. per yard, what is the amount of his bill?
Ans. 46l. 9s. 11d. $2\frac{1}{4}$ gr.
21. A person having $\frac{1}{3}$ of a ship, sells $\frac{2}{3}$ of his share at 765.6 dol. what is the proportional worth of the whole vessel?
Ans. 1435.5 dol.

INVERSE PROPORTION.

RULE.

After the necessary preparations, multiply the first and second terms together, and divide that product by the third term: Or,

Invert the dividing term, and multiply them together for the fractional answer. See the last notes.

EXAMPLES.

1. What quantity of shalloon that is $\frac{3}{4}$ yd. wide, will line $7\frac{1}{2}$ yards of cloth, $1\frac{1}{4}$ yards wide?

First, $7\frac{1}{2} = \frac{15}{2}$ yd. } yd. yd. yd. yd.
 Second, $1\frac{1}{4} = \frac{5}{4}$ yd. } As $\frac{3}{4} \dots \frac{15}{2} :: \frac{5}{4} \dots 15$ Ans.

Or Cancelled; $3 \ 15 \ 4$

$$\frac{2}{2} \cdot \frac{2}{3} = 15 \text{ yds.}$$

2. If $3\frac{1}{2}$ yd. of cloth that is $1\frac{1}{2}$ yd. wide, be sufficient to make a cloak, how much Persian, which is but $\frac{1}{2}$ yd. wide, will be required to line it?

Ans. 4yd. 3qr. 2na.

3. 16 men finishing a piece of work in $28\frac{1}{2}$ days; the time is required in which 12 men should do it?

Ans. $37\frac{1}{2}$ days.

4. In exchanging $20\frac{1}{2}$ yd. of cloth of $1\frac{1}{2}$ yd. wide, for some of the same quality of $\frac{3}{4}$ yd. wide; what quantity of the latter makes an equal barter?

Ans. $34\frac{1}{2}$ yd.

5. If 3 men can perform a service in $4\frac{1}{2}$ hours; in what time may ten effect it?

Ans. 1hr. 21min.

6. When wheat is at 66 cts. per bushel, if the penny loaf weighs 7 oz. what is it per bushel, when the penny loaf weighs $2\frac{1}{2}$ oz.

Ans. 1.848 dol.

7. If, when the price of wheat is 6½s. per bushel, the penny loaf weighs 9 oz. what must it weigh when that grain sells at 4½s. per bushel?

Ans. 12 oz. 8 dr.

8. A piece of tapestry 3 ells Flemish wide, and four long, is to be lined with stuff which is but $\frac{3}{4}$ yd. wide; how many yards are sufficient?

Ans. 9yd.

9. Suppose 275 yd. of cloth, that is $1\frac{1}{2}$ yd. wide, make coats for 130 men; what number of yards of shalloon of $\frac{3}{4}$ yd. wide, will be requisite to line them?

Ans. 458½ yd.

10. How many yards of baize, ell English wide, will be sufficient to line 20 yards of camlet, that is $\frac{3}{4}$ yd. wide?

Ans. 12yd.

11. A merchant bartering 5½C. of sugar at 6½d. per lb. for tea, at 8½s. per lb. would know what quantity of the latter article he is to receive?

Ans. $43\frac{1}{8}$ lb.

12. What number of pieces of merchandise, at 20½s. per piece, are equivalent to 240½ pieces, at 12½s. per piece?

Ans. $149\frac{1}{11}$ pieces.

13. A lends to B, 100½l. for 6½ months; what sum should B lend A for 3½ years to requite his kindness?

Ans. 14l. 11s. 9d. $1\frac{1}{4}$ qr.

14. How many yards of cloth, at 8½s. per yard, must be given for 26½ yards, at 5½s. a yard?

Ans. 17yd. 1qr. $3\frac{1}{4}$ na.

THE DOUBLE RULE OF THREE IN VULGAR FRACTIONS. RULE.

PREPARE the terms, if necessary, then state and work them agreeably to the directions given in whole numbers. Or,

Invert the dividing terms, and multiply the upper figures continually for the numerator, and those below for the denominator of the fractional answer.

Note. The note to Case 5, in Reduction, may be applied here.

EXAMPLES.

1. If $\frac{3}{4}$ yds. of cloth, that is $\frac{7}{8}$ yd. wide, cost $\frac{2}{3}$ £. what is the value of $\frac{4}{5}$ yd. that is $1\frac{1}{4}$ yd. wide, being of the same quality?

$$\begin{array}{l} \text{If } \frac{3}{4} \text{ yd. } \left\{ \begin{array}{l} \frac{7}{8} \text{ yd.} \\ \frac{2}{3} \text{ £.} \end{array} \right. \left\{ \begin{array}{l} \frac{4}{5} \text{ yd.} \\ \frac{1}{4} \text{ yd.} \end{array} \right. \\ \frac{3}{4} \times \frac{7}{8} = \frac{21}{32} \quad \left\{ \begin{array}{l} \frac{7}{8} \div \frac{21}{32} = \frac{32}{21} = \frac{16}{10.5} = \frac{16}{105} \end{array} \right. = \frac{2}{3} \text{ £.} = 13s. 4d. \text{ Ans,} \\ \frac{4}{5} \times \frac{1}{4} \times \frac{16}{105} = \frac{16}{105} \end{array}$$

Or, cancelled ; $\frac{4 \times 8 \times 2 \times 5 \times 7}{3 \times 7 \times 5 \times 8 \times 4} = \frac{2}{3} \text{ £.} = 13s. 4d.$

2. If 9 students spend $10\frac{1}{2}$ £. in 18 days, what sum will 20 students spend in 30 days? *Ans.* 39£. 18s. $4\frac{1}{2}$ d.

3. The labour of 3 men for $19\frac{1}{2}$ days came to $8\frac{2}{3}$ £. at the same rate, what must 20 men have for working $100\frac{1}{2}$ days?

Ans. 305£. 0s. $8\frac{2}{3}$ d.

4. If 5 persons drink $7\frac{1}{2}$ gallons of beer in a week, what quantity will serve 8 persons $22\frac{1}{2}$ weeks? *Ans.* $280\frac{1}{2}$ gal.

5. Fourteen persons, upon examining into their expenses for 20 weeks past, found they had laid out $40\frac{1}{2}$ £. at the same rate, in what time may $20\frac{1}{2}$ £. be expended by 46 persons?

Ans. $3\frac{1}{11}\frac{1}{3}$ weeks.

6. If $13\frac{1}{2}$ £. in $\frac{2}{3}$ of a year, gain $1\frac{1}{2}$ £. interest, what interest will 50£. gain in $\frac{1}{2}$ of a year; and at what rate per cent. per annum?

Ans. 2£. 5s. 1d. $2\frac{2}{3}$ gr. at $10\frac{1}{2}$ per cent.

7. If 50£. in $\frac{1}{2}$ of a year gain 2£. 5s. 1d. $2\frac{2}{3}$ gr. in what time will $13\frac{1}{2}$ £. gain $1\frac{1}{2}$ £. and at what rate per cent. per annum?

Ans. $\frac{2}{3}$ years at $10\frac{1}{2}$ per cent.

8. When 12 persons use $1\frac{1}{2}$ lb. of tea per month; how much should a family of 8 persons provide for $\frac{1}{2}$ a year? *Ans.* $4\frac{1}{2}$ lb.

9. Two brothers at school compute the expense of their boarding, tuition, &c. for $\frac{2}{3}$ of a year to be $56\frac{1}{2}$ £. how much will the education of three sons for $5\frac{1}{2}$ years cost their father at that rate? *Ans.* 600£.

INVOLUTION : OR, THE RAISING OF POWERS.

A **POWER** is the product arising from multiplying any given number into itself continually a certain number of times ; thus,

$$2 \times 2 = 4 \text{ is the second power or square of 2.}$$

$$2 \times 2 \times 2 = 8 \text{ is the third power or cube of 2.}$$

$$2 \times 2 \times 2 \times 2 = 16 \text{ is the fourth power of 2, \&c.}$$

The number denoting the power, is called the **index** or the **exponent** of that power.

If two or more powers are multiplied together, their product is that power whose index is the sum of the exponents of the factors ; thus,

$$2 \times 2 = 4 \text{ the square of 2, } 4 \times 4 = 16 = 4\text{th power of 2; and } 16 \times 16 = 256 = 8\text{th power of 2, \&c.}$$

TABLE OF THE FIRST NINE POWERS.

Roots.	Squares.	Cubes.	4th power.	5th power.	6th power.	7th power.	8th power.	9th power.
1	1	1	1	1	1	1	1	1
2	4	8	16	32	64	128	256	512
3	9	27	81	243	729	2187	6561	19683
4	16	64	256	1024	4096	16384	65536	262144
5	25	125	625	3125	15625	78125	390625	1953125
6	36	216	1296	7776	46656	279936	1679616	10077696
7	49	343	2401	16807	117649	823543	5764801	40353607
8	64	512	4096	32768	262144	2097152	16777216	134217728
9	81	729	6561	59049	531441	4782969	43046721	387420489

EXAMPLES.

1. What is the fifth power of 7?
 $7 \times 7 \times 7 \times 7 \times 7 = 16807 = \text{fifth power.}$
2. What is the third power or cube of 35? *Ans. 42875.*
3. What is the fourth power of $\frac{3}{4}$? $\frac{81}{256}$
4. What is the fifth power of .029? .000000020511149.
5. What is the sixth power of 5.03? 16196.005304479729.
6. What is the eighth power of $3\frac{1}{2}$? 17857 $\frac{38881}{256}$.

EVOLUTION: OR, THE EXTRACTING OF ROOTS.

THE root of a number, or power, is such a number, as being multiplied into itself a certain number of times, will produce that power. Thus, 2 is the square root of 4, because $2 \times 2 = 4$; and 4 is the cube root of 64, because $4 \times 4 \times 4 = 64$; and so on.

THE SQUARE ROOT.

THE square of a number is the product arising from that number multiplied into itself.

Extraction of the square root is the finding of such a number, as being multiplied by itself, will produce the number proposed.

RULE.

1. Distinguish the given number into periods of two figures each; beginning at the unit's place, or decimal point; and when the decimal does not consist of any even number of figures, annex a cypher; and equal to the periods of whole numbers and decimals respectively, will be the places of each in the root.

2. Deduct from the first period the greatest square it contains, setting the root thereof as a quotient figure; and doubling it for a divisor; and bring down the second period to the remainder, for a dividend.

3. Try how often the said divisor, with the resulting figure of this trial, thereto annexed, are contained in the dividend, and set this resulting figure to both division and root; then multiply and subtract as in division, and bring down the next period.

4. Double the ascertained root for a new divisor, and repeat the process to the end.

PROOF.

Square the root, adding in the remainder (if any) which will equal the number given.

EXAMPLES.

1. What is the square root of 30138.696025?

$$\sqrt{30138.696025} (173.605 \text{ Ans.})$$

1

$$\begin{array}{r} 27 \overline{) 201} \\ 189 \end{array}$$

$$\begin{array}{r} 343 \overline{) 1238} \\ 1029 \end{array}$$

$$\begin{array}{r} 3466 \overline{) 20969} \\ 20796 \end{array}$$

$$\begin{array}{r} 347205 \overline{) 1736025} \\ 1736025 \end{array}$$

0

Note. When one more than half the figures of the root are found, the rest may be obtained by working as in contracted division of decimals.

2. Required the square root of 14876.2357?

$$\sqrt{14876.2357} (121.968175)$$

1

$$\begin{array}{r} 22 \overline{) 48} \\ 44 \end{array}$$

$$\begin{array}{r} 241 \overline{) 476} \\ 241 \end{array}$$

$$\begin{array}{r} 2429 \overline{) 23523} \\ 21861 \end{array}$$

$$\begin{array}{r} 24386 \overline{) 166257} \\ 146316 \end{array}$$

$$\begin{array}{r} 24392 \overline{) 19941} (8175 \end{array}$$

427

183

13

1

3. Required the square root of 5499025? **Facit** 2347
4. What is the square root of 74770609? **Ans.** 8647
5. What is the square root of 368863? **607.34092+**
6. What is the square root of 3271.4007? **57.19+**
7. What is the square root of 2.2710957? **1.50701+**
8. What is the square root of 10? **3.162277+**
9. What is the square root of .0003272481? **.01809**
10. Required the side of a square acre of land.

Facit 12.649+ per.

11. A certain number of men gave 30s. 1d. for a charitable purpose; each man giving as many pence as there were men; query their number? **Ans.** 19 men.

12. If a circular pipe of 1.5 inches diameter, fill a cistern in 5 hours; in what time would it be filled by one of 3.5 inches diameter? **Ans.** 55 min. 6 sec.

13. If 484 trees be planted in a square orchard, how many must be in a row each way? **Ans.** 22.

Note. 1st, The square of the longest side of a right angled triangle, is equal to the sum of the squares of the other two sides; and consequently the difference of the square of the longest, and either of the other, is the square of the remaining side.

2d, The square root of a vulgar fraction is found by reducing it to its lowest terms, and extracting the root of the numerator for a numerator, and of the denominator for a denominator. If it be a surd, reduce it to its equivalent decimal, &c.

3d, A mixt number may be reduced to an improper fraction, or a decimal, and the root thereof extracted as before.

14. The wall of a fortress is 17 feet high, which is surrounded by a moat 20 feet in breadth; query the length of a ladder to reach from the outside of the moat to the top of the wall?

Ans. 26.2 feet.

15. A line of 36 yards long will exactly reach from the top of a fort to the opposite bank of a river, known to be 24 yards broad; the height of the wall is required.

Ans. 26.83+ yards.

16. Suppose a ladder 60 feet long, be so planted as to reach a window 37 feet from the ground on one side of the street, and without moving it at the foot, will reach a window 23 feet high on the other side; what breadth was the street of?

Ans. 102.64 feet.

- | | |
|---|------------------|
| 17. What is the square root of 3844 ? | <i>Ans.</i> 62 |
| 18. What is the square root of 1944 ? | 44 |
| 19. What is the square root of 3136 ? | 56 |
| 20. What is the square root of 3721 ? | 61 |
| 21. What is the square root of 1764 ? | 42 |
| 22. What is the square root of 7649 ? | $87.649+$ |

THE CUBE ROOT.

THE cube of a number, is the product of that number multiplied into its square.

Extraction of the cube root, is the finding of such a number, as being multiplied into its square, will produce the number proposed.

RULE.

First, Distinguish the proposed number into periods of three figures each, beginning at the unit's place or decimal point; and when the decimal does not consist of a complete period or periods, annex a cypher or cyphers to make it so; and the places of the root will be as many as the periods of the given cube in whole numbers and decimals respectively.

Secondly, Find the greatest root of the left hand period, which place to the right of the given number, and subtract the cube thereof from said period; and to the remainder bring down the next period for a dividend.

Thirdly, Take the triple square of the ascertained root for a defective divisor.

Fourthly, Reserve mentally the units and tens of the dividend, and try how often the defective divisor is contained in the rest; place the result of this trial to the root, and its square to the right of said divisor, supplying the place of tens with a cypher, if the square be less than 10.

Fifthly, Complete the divisor, by adding thereto the product of the last figure of the root by the rest, and by 30.

Sixthly, Multiply, subtract, and bring down the next period for a dividend, for which find a divisor as before; and so proceed with every period.

Note. The defective divisors, after the first, may be more concisely found by addition, thus: to the last complete divisor, add the number which completed it, with twice the square of the last figure in the root; the sum will be the next defective divisor.

EXAMPLES.

1. What is the cube root of 444194.947?

$$\begin{array}{r} 444194.947(76.3 \text{ Ans.} \\ \underline{348.} \end{array}$$

$$\left\{ \begin{array}{l} \text{Defective div. \& square of } 6 = 14736) 101194 \\ + 1260 = \text{complete divisor} \quad 15996) 95976 \end{array} \right.$$

$$\left\{ \begin{array}{l} \text{Defective div. square of } 3 = 1732809) 5218947 \\ + 6840 = \text{complete divisor} \quad 1739649) 5218947 \end{array} \right.$$

0

2. What is the cube root of 34328125? *Ans.* 325
 3. What is the cube root of 84604519? 439
 4. What is the cube root of 259694072? 638
 5. What is the cube root of 22069810125? 2805
 6. What is the cube root of 673373097125? 8765
 7. What is the cube root of 12.977875? 2.35
 8. What is the cube root of .001906624? .124
 9. What is the cube root of 15926.972504? 25.16 +
 10. What is the cube root of 171.46776406? 5.555 +
 11. What is the difference between half a solid foot, and a solid half foot? *Ans.* 3 half feet.
 12. In a cubical foot, how many cubes of 6 inches, and how many of 3, are contained therein? *Ans.* 8 of 6 in. — and 64 of 3 in.
 13. The contents of an oblong cellar is 1953.125 cubic feet; required the side of a cubical cellar that shall contain just as much. *Ans.* 12.5 feet.
 14. A stone of a cubic form contains 474552 solid inches; what is the superficial content of one of its sides? *Ans.* 6084 inches.
 15. A merchant laid out 6917. 4s. in cloths, but forgot the number of pieces purchased, also how many yards were in each piece, and what they cost him per yard; but remembers that they cost him as many shillings per yard as there were yards in each piece, and that there were just as many pieces; query the number purchased? *Ans.* 24.

Note 1. The cube root of a vulgar fraction is found by reducing it to its lowest terms, and extracting the root of the

numerator for a numerator, and of the denominator for a denominator. If it be a surd, extract the root of its equivalent decimal.

2. A mixt number may be reduced to an improper fraction, or a decimal, and the root thereof extracted.

16. What is the cube root of $\frac{343}{1111}$?	<i>Ans.</i> $\frac{7}{11}$
17. What is the cube root of $\frac{648}{3008}$?	$\frac{8}{14}$
18. What is the cube root of $\frac{1}{8}$?	.763
19. What is the cube root of $\frac{1}{4}$?	.949+
20. What is the cube root of $13\frac{1}{2}$?	2.3908+
21. What is the cube root of $42\frac{1}{2}$?	3 $\frac{1}{2}$
22. What is the cube root of $51\frac{1}{2}$?	1 $\frac{1}{2}$
23. What is the cube root of $405\frac{1}{2}$?	7 $\frac{1}{2}$
24. What is the cube root of $7\frac{1}{2}$?	1.966+
25. What is the cube root of $9\frac{1}{2}$?	2.092+

GENERAL RULE FOR EXTRACTING ROOTS OF ALL POWERS.

1. PREPARE the given number for extraction, by pointing it as the root directs.

2. Find the first figure in the root, either by trial or in the Table of Powers.

3. Subtract its involution from the first period.

4. To the remainder, annex the first figure in the next period. Call this a dividend.

5. Involve the whole root last found, into the next less power to that given, and multiply by the index of the given power, and call this a divisor.

6. Find a quotient figure by division, and annex it to the root.

7. Involve all the root (thus found) into the given power, and subtract this from the number of periods in the given number, as are represented by the last figure brought down.

8. To the remainder, bring down the first figure of the next period, for a new dividend.

9. Find a new divisor, as before, and thus proceed to the end.

EXAMPLES.

1. What is the cube root of 115501303 ?

$$\begin{array}{r} 115501303 \\ 64 \end{array} (487 \text{ Ans.}$$

$$\begin{array}{r} 48 \overline{) 515} \end{array} \text{ Dividend.}$$

$$\begin{array}{r} 110592 \end{array} \text{ Subtrahend.}$$

$$\begin{array}{r} 6912 \overline{) 49093} \end{array} \text{ Dividend.}$$

$$\begin{array}{r} 115501303 \end{array} \text{ Subtrahend.}$$

$$4 \times 4 \times 4 = 48 \text{ Divisor.}$$

$$48 \times 48 \times 48 = 110592 \text{ Subtrahend.}$$

$$48 \times 48 \times 48 = 110592 \text{ Subtrahend.}$$

$$487 \times 487 \times 487 = 115501303 \text{ Subtrahend.}$$

2. What is the fourth root of 56249134561 (487 Ans.

$$\begin{array}{r} 256 \end{array}$$

$$\begin{array}{r} 256 \overline{) 3064} \end{array} \text{ Dividend.}$$

$$\begin{array}{r} 5308416 \end{array} \text{ Subtrahend.}$$

$$\begin{array}{r} 442368 \overline{) 3164974} \end{array} \text{ Dividend.}$$

$$\begin{array}{r} 56249134561 \end{array} \text{ Subtrahend.}$$

$$4 \times 4 \times 4 \times 4 = 256 \text{ Divisor.}$$

$$48 \times 48 \times 48 \times 48 = 5308416 \text{ Subtrahend.}$$

$$48 \times 48 \times 48 \times 48 = 5308416 \text{ Subtrahend.}$$

$$487 \times 487 \times 487 \times 487 = 56249134561 \text{ Subtrahend.}$$

3. What is the cube root of
- $\frac{1}{8}$
- ?
- Ans. .7937005

4. What is the fourth root of 97.41 ?
- 3.1415999

5. What is the sixth root of 21035.8 ?
- 5.254087

6. What is the seventh root of 34487717467307513182492
- Ans. 32017

7. What is the eighth root of 112101628132047623624649
- Ans. 13527

8. What is the ninth root of 97637960298907396027963029
- Ans. 2148.7201

9. What is the 365th root of 1.05 ?
- Ans. 1.0001335

COMPOUND INTEREST.

Note. The amount of 1l. or dollar, for quarters of a year is found as follows, and so the following table constructed at the different rates, or ratios.

$\sqrt[4]{1.06} = 1.014674$, for 1 quarter; $\sqrt[2]{1.06} = 1.029563$, for 2; and $1.014674 + 1.029563 = 1.044671$, for 3 quarters.

The ratio involved to the time is the amount of 1*l.* or dol. for the time proposed; or, it is that power of the Ratio which is indicated by the given number of years, as a square for 2 years, a cube of 3, &c. thus, $1.06 + 1.06 + 1.06 + 1.06$.

$\sqrt[4]{1.06} = 1.262477$ = the fourth power of 1.06 or the ratio involved to 4 years.

When the ratio is to be involved to years and quarters, the power for the years is to be multiplied by the proper quarterly amount; as, $1.262477 + 1.044671 = 1.318873$ for $4\frac{1}{4}$ years, &c.

The power or the amount of 1*l.* or dol. may also be obtained for months, and days (nearly) by adding the monthly simple interest of 1*l.* or dollar, or proper parts thereof, to the amount of the quarter next preceding the expiration of the given time, for what that time exceeds the said quarter, thus,

Amount for $\frac{1}{4}$ yr. =	1.029563	For $4\frac{1}{4}$ yr. =	1.318873
Int. of 1 <i>l.</i> for 1 mo. =	.005000		.005000
One sixth, for 5 da. =	.000833		.000833

For 7 mo. 5 da. = 1.035396, For 4y. 10m. 5d. = 1.324706

The ratio may be thus involved to any time whatever; but the operation is facilitated by the following tables; which may be extended to 100 years, or upwards, by multiplying the amount for 50, by that for the time above 50, &c.

TABLE I.

Rate per Cent.	Amount for 1 <i>l.</i> or dollar, for a year, and for quarters, at Compound Interest.				Simp. Int. of 1 <i>l.</i> or dol. for 1 month.
	Ratio.	For 3 qrs.	For 2 qrs.	For 1 qr.	
3	1.03	1.022416	1.014889	1.007417	.002500
$3\frac{1}{2}$	1.035	1.026137	1.017349	1.008637	.002917
4	1.04	1.029852	1.019804	1.009853	.003333
$4\frac{1}{2}$	1.045	1.033563	1.022252	1.011065	.003750
5	1.05	1.037270	1.024695	1.012272	.004167
$5\frac{1}{2}$	1.055	1.040973	1.027132	1.013475	.004583
6	1.06	1.044671	1.029563	1.014674	.005000
$6\frac{1}{2}$	1.065	1.048364	1.031988	1.015868	.005417
7	1.07	1.052053	1.034408	1.017058	.005833

Compound Interest.

TABLE II. Shewing the amount of £. or dol. from one y to fifty.

y.	3½ pr. ct.	4 pr. ct.	4½ pr. ct.	5 pr. ct.	5½ pr. ct.	6 pr. ct.
1	1.0350000	1.0400000	1.0450000	1.0500000	1.0550000	1.0600000
2	1.0712250	1.0816800	1.0921250	1.1025600	1.1130050	1.1234500
3	1.1087178	1.1248640	1.1410100	1.1571560	1.1733020	1.1894480
4	1.14752.0	1.1698565	1.1927198	1.2155062	1.2382526	1.2610000
5	1.1876803	1.2165529	1.2401819	1.2732615	1.3069598	1.3406680
6	1.2292553	1.2651190	1.2892601	1.3400956	1.3788425	1.4175181
7	1.2722792	1.3151405	1.3403818	1.4071014	1.4545783	1.5036302
8	1.3168000	1.3665500	1.3921905	1.4744554	1.5347802	1.5966480
9	1.3628973	1.4233118	1.4503951	1.5513242	1.6190939	1.6894728
10	1.4105987	1.4832142	1.5529691	1.6286916	1.7081440	1.7908400
11	1.4598997	1.5391540	1.6228530	1.7103393	1.8020919	1.8962965
12	1.5110886	1.6019322	1.6958314	1.7958553	1.9012069	2.0121964
13	1.5650569	1.6650735	1.7721961	1.8851191	2.0057752	2.1329282
14	1.6186845	1.7316764	1.8519449	1.9793616	2.1160907	2.2609059
15	1.6753488	1.8009155	1.9352324	2.0789291	2.2324756	2.396581
16	1.7338980	1.873812	2.0222701	2.1828745	2.3552617	2.403517
17	1.7946755	1.9519005	2.1133768	2.2920193	2.4846011	2.6927727
18	1.8574892	2.0258161	2.204167	2.4066192	2.6214652	2.6946891
19	1.9222503	2.1068491	2.3079603	2.5260562	2.7656458	3.0255895
20	1.9897888	2.191231	2.4117140	2.6532977	2.9177565	3.2671355
21	2.0594114	2.2787650	2.5202411	2.7886625	3.0782529	3.5895656
22	2.1315115	2.3699187	2.6333520	2.9252907	3.2475557	3.6055714
23	2.2061144	2.4647155	2.7521663	3.0715287	3.4261562	3.6191181
24	2.2833284	2.5633941	2.8760193	3.2250993	3.6145285	4.0189346
25	2.3632240	2.6658369	3.0054311	3.3865510	3.8135910	4.2946707
26	2.4459985	2.7721697	3.1406790	3.5556726	4.0291279	4.5493829
27	2.5315671	2.8833685	3.2820085	3.7331563	4.2413990	4.8223468
28	2.6201719	2.9987933	3.4293899	3.9201291	4.4778419	5.1116867
29	2.7118779	3.1186514	3.5840364	4.1161956	4.7241232	5.4185679
30	2.8067817	3.2433975	3.7453181	4.3219123	4.9839169	5.7454912
31	2.9050314	3.3731331	3.9133574	4.5380394	5.2506671	6.0881007
32	3.0068705	3.5080587	4.0899810	4.7649114	5.5472608	6.4553667
33	3.1119128	3.6481831	4.2710301	5.0031885	5.8523600	6.8465899
34	3.2208803	3.7943168	4.4663615	5.2535179	6.1742388	7.2510263
35	3.3335904	3.9460189	4.6673478	5.5100152	6.5181290	7.6660888
36	3.4502661	4.1038325	4.8737884	5.7918101	6.8720832	8.1422520
37	3.5710254	4.2680398	5.0918904	6.0814069	7.2500178	8.6360871
38	3.6960113	4.4388134	5.3232192	6.3851772	7.6488004	9.1542523
39	3.8253717	4.6163559	5.5657899	6.7017511	8.0691844	9.7035074
40	3.9592597	4.8010293	5.8163445	7.0299557	8.5139040	10.2857178
41	4.0978337	4.9936114	6.0731099	7.3919881	8.9815378	10.9028608
42	4.2412879	5.1927893	6.3514246	7.7615871	9.4753224	11.5570825
43	4.3897020	5.4004952	6.6375522	8.1496569	9.9961111	12.2504547
44	4.5433415	5.6165150	6.9322121	8.5571502	10.5464938	12.9854817
45	4.7023585	5.8411758	7.2433730	8.9850777	11.1265504	13.7646107
46	4.8669411	6.0718296	7.5746197	9.434561	11.7385217	14.5904875
47	5.0372840	6.3191668	7.9154045	9.9059710	12.3741404	15.4639168
48	5.2135889	6.5730529	8.2715977	10.4011698	13.0352681	16.3938716
49	5.3960345	6.8333493	8.6438196	10.9213331	13.7388779	17.3775039
50	5.5846288	7.1006839	9.0327915	11.4678607	14.4818700	18.4201941

CASE 2.

When the time is years and parts of a year ;

RULE.

Multiply the principal by the ratio involved to the time (found either by involution, or in Tables I. and II.) and the product will be the amount.

EXAMPLES.

1. What is the amount of 768 dol. for 3 years and 3 months, at 6 per cent. per annum ?

$$1.191016 \times 1.014674 = 1.208493 \times 768 = 928.122624 \text{ dol.} \\ = 928 \text{ dol. 12 cts. 2.624m. } \textit{Ans.}$$

2. What is the compound interest of 764l. for 4 years and 9 months, at 6 per cent. per annum ? *Ans. 243l. 12s. 4½d.*

3. What is the amount at compound interest of 622.86 dol. for 3 years, 7 months, and 15 days, at 4½ per cent. per annum ? *Ans. 730 dol. 60 cts.*

4. What is the compound interest of 863 dol. at 5 per cent. per annum, for 4 years, 10 months, and 10 days ? *Ans. 230 dol. 90 cts.*

CASE 3.

DISCOUNT AT COMPOUND INTEREST.

Or, the amount, rate, and time given, to find the principal.

RULE.

Divide the amount by the ratio involved to the time.

EXAMPLES.

1. What principal must be put to interest, to amount to the sum of 520l. 18s. 7½d. in 3 years at 5 per cent. per annum ?

$$\text{£. } 520 \text{ 18s. } 7\frac{1}{2}\text{d.} = \text{£. } 520.93125$$

$$1.05 \times 1.05 \times 1.05 = 1.157625$$

$$1.157625)520.93125(450l. \textit{Ans.}$$

2. What principal must be put to interest to amount to 928 dol. 12 cts. 2.600256512m. in 3 years and 3 months, at 6 per cent. per annum ? *Ans. 768 dol.*

3. What principal will amount to 1007*l*. 12*s*. 4*d*. 217227190656 *qr.* in 4 years and 9 months, at 6 per cent. per annum? *Ans.* 764*l*.

4. What principal, in 3 years, 7 months, and 15 days, will amount to 730.601318357091342 *dol* at 4½ per cent. per annum? *Ans.* 622 *dol*. 86 *cts*.

5. What principal will amount to 1093 dollars 90 cents 5.5473339756 *m.* in 4 years, 10 months and 10 days, at 5 per cent. per annum? *Ans.* 863 *dol*.

CASE 4.

The principal, rate, and amount given, to find the time;

RULE.

Divide the amount by the principal, and involve the ratio till it equals the quotient; the power to which it is raised will indicate the time; Or,

By Table II.

Divide as before; find the quotient under the rate, and it will shew the time against it in the same line.

Note. If the quotient be between 2 numbers under the rate, then say, as the difference of these 2 numbers, is to one year, so is the difference between the preceding number and the quotient, to the parts (nearly) which are to be annexed to the next preceding year.

EXAMPLES.

1. In what time will 450*l*. amount to 520*l*. 18*s*. 7½*d*. at 5 per cent. per annum?

$$450)520.93125(1.157625, \text{ and}$$

3

$$1.157625 = 1.05 \times 1.05 \times 1.05 = 1.157625 \text{ for 3 years. } \textit{Ans.}$$

By the table 1.157625, under 5 per cent. stand opposite 3 years.

2. In what time will 768 *dol.* amount to 928.122600256512 *dol.* at 6 per cent. per annum? *Ans.* 3 yr. 3 mo.

3. In what time will 764*l*. amount to 1007.6189762783236*l*. at 6 per cent. per annum? *Ans.* 4½ years.

4. In what time will \$622.86 amount to 730.601318357091342 dol. at $4\frac{1}{2}$ per cent. per annum? *Ans.* 3 yr. 7 mo. 15 da.

CASE 5.

The principal, amount, and time given, to find the rate of interest.

RULE.

Divide as in case 4; and extract such a root of the quotient as is indicated by the time; Or,

By Table II.

Find the quotient against the time, and over it the rate per cent.

Note. When the time consists of parts of a year, or of years and parts, express it in the vulgar fraction of a year in its lowest terms; then involve the quotient mentioned in the rule, to the power indicated by the denominator, and from this power extract the root denoted by the numerator for the ratio; or, find the numerator in the column of years (table II.) and the said power opposite thereto, and, over this the rate required.

EXAMPLES.

1. At what rate per cent. will 450*l.* amount to 520*l.* 18*s.* 7*d.* in 3 years?

450)520.93125(1.157625, and

3

$\sqrt[3]{1.157625} = 1.05 =$ the ratio of 5*l.* per cent. *Ans.*

By the table; Find 1.157625 opposite 3 years, and over it 5 per cent.

2. At what rate per cent. per annum, will 768 dol. amount to 928.122600256512 dol. in 3 years and three months?

Ans. 6 per cent.

3. At what rate per cent. will 764*l.* amount to 1.007*l.* 12*s.* 4*d.* .317227190656 in $4\frac{1}{4}$ years? *Ans.* 6 per ct.

4. At what rate per cent. will 622 dol. 86 cts. amount to 730 dol. 60 cts. 1.318357091342 mills, in 3 years, 7 months, and 15 days? *Ans.* $4\frac{1}{2}$ per cent.

ANNUITIES AT COMPOUND INTEREST.

An annuity is a sum of money payable yearly, half yr or quarterly, for a number of years, during life, or for and may draw interest if it remain unpaid after it becomes Tables to facilitate the calculations of annuities.

TABLE III. Shewing the amount of 1*l*. or dol. annu

y.	4 per ct.	4½ per ct.	5 per ct.	5½ per ct.	6 per ct.
1	1,	1,	1,	1,	1,
2	2,04	2,045	2,05	2,055	2,06
3	3,1216	3,137025	3,1525	3,168025	3,1836
4	4,246484	4,272191	4,310125	4,342266	4,37466
5	5,416322	5,470710	5,525631	5,581091	5,63709
6	6,632975	6,716892	6,801913	6,888051	6,97591
7	7,898294	8,019152	8,142002	8,266894	8,39385
8	9,214226	9,330014	9,549109	9,721573	9,89746
9	10,582795	10,802114	11,026524	11,256259	11,49131
10	12,006107	12,23821	12,577892	12,875354	13,18079
11	13,486351	13,841179	14,206787	14,563496	14,97164
12	15,025805	15,464032	15,917126	16,38559	16,86994
13	16,626838	17,159913	17,712963	18,286798	18,82213
14	18,291911	18,932109	19,598632	20,292572	21,01506
15	20,023583	20,784054	21,578563	22,408663	23,27597
16	21,824581	22,719837	23,657492	24,62114	25,67252
17	23,697512	24,741707	25,840366	26,996402	28,21268
18	25,645418	26,855084	28,132985	29,481205	30,90565
19	27,671229	29,038562	30,532004	32,102671	33,75998
20	29,778078	31,371423	33,065594	34,868918	36,78559
21	31,969202	33,783157	35,719252	37,786075	39,99272
22	34,24797	36,303878	38,505214	40,864309	43,39229
23	36,617888	38,93703	41,531475	44,111846	46,90582
24	39,082604	41,689196	44,501999	47,597998	50,51557
25	41,645908	44,56521	47,727099	51,152588	54,26451
26	44,311745	47,570645	51,119454	54,965979	58,15638
27	47,084214	50,711824	54,669126	58,989109	62,70576
28	49,967582	53,98838	58,402583	63,23851	66,52811
29	52,966236	57,423033	62,322712	67,711353	70,63979
30	56,064938	61,007069	66,438347	72,455472	75,05818
31	59,262335	64,752388	70,70679	77,419429	81,80167
32	62,701469	68,666245	75,293829	82,677498	89,88977
33	66,269527	72,756236	80,082771	88,22476	97,84316
34	69,857904	77,030236	85,066959	94,077122	104,18375
35	73,622225	81,496612	90,329807	100,251363	111,43478
36	77,586214	86,163966	95,836323	106,765198	119,12026
37	81,702243	91,041344	101,628139	113,637274	127,26811
38	85,970836	96,138205	107,709546	120,837324	135,90420
39	90,40915	101,464424	114,095023	128,536127	145,05845
40	95,025516	107,030323	120,798774	136,805614	154,78196

Annuities at Compound Interest.

TABLE IV. Shewing the present worth of **1l. or dol. annuity,**
for any number of years, from 1 to 40.

r.	4 per cent	4½ per ct.	5 per cent	5½ per ct.	6 per cent	yr.
1	0,96154	0,95694	0,95231	0,94786	0,94339	1
2	1,88609	1,87267	1,85941	1,84632	1,83359	2
3	2,77509	2,74876	2,72325	2,69793	2,67301	3
4	3,62939	3,58752	3,54595	3,50514	3,4651	4
5	4,45182	4,38997	4,32948	4,27028	4,21236	5
6	5,24214	5,15787	5,07569	4,99553	4,91732	6
7	6,40203	5,8927	5,78637	5,68297	5,58238	7
8	6,73274	6,59589	6,46321	6,33457	6,20979	8
9	7,43533	7,26879	7,10782	6,95220	6,80169	9
10	8,11089	7,91272	7,72173	7,53762	7,36008	10
11	8,76048	8,52892	8,30641	8,09254	7,88687	11
12	9,38507	9,11858	8,86325	8,61872	8,38384	12
13	9,98565	9,68285	9,39357	9,11708	8,85268	13
14	10,56312	10,22282	9,89864	9,58965	9,29498	14
15	11,11839	10,73954	10,37965	10,03759	9,71225	15
16	11,65229	11,23401	10,83777	10,46216	10,10589	16
17	12,16567	11,70719	11,27407	10,86461	10,47726	17
18	12,65929	12,15999	11,68953	11,24607	10,8276	18
19	13,13394	12,59329	12,08532	11,60765	11,15811	19
20	13,59032	13,00793	12,46221	11,95038	11,46992	20
21	14,02916	13,40472	12,82115	12,27524	11,76407	21
22	14,45111	13,78442	13,163	12,58317	12,04158	22
23	14,85684	14,14777	13,48857	12,87504	12,30338	23
24	15,24696	14,49548	13,79864	13,15170	12,55035	24
25	15,62208	14,82821	14,09394	13,41391	12,78335	25
26	15,98277	15,14661	14,37518	13,66250	13,00316	26
27	16,32959	15,45133	14,64303	13,89810	13,21053	27
28	16,66306	15,74287	14,89813	14,12142	13,40616	28
29	16,98371	16,02189	15,14107	14,33310	13,59072	29
30	17,29203	16,28889	15,37245	14,53373	13,76483	30
31	17,58849	16,54439	15,59281	14,71393	13,92908	31
32	17,87355	16,78889	15,80268	14,90420	14,08404	32
33	18,14764	17,02286	16,00235	15,07507	14,23023	33
34	18,41125	17,24676	16,1929	15,23703	14,36814	34
35	18,66461	17,46101	16,37419	15,39055	14,19825	35
36	18,90828	17,66604	16,54685	15,53607	14,62098	36
37	19,14258	17,86224	16,71129	15,67400	14,73678	37
38	19,36786	18,04999	16,86789	15,80474	14,84602	38
39	19,58448	18,22965	17,01704	15,92866	14,94907	39
40	19,79277	18,40158	17,15909	16,04612	14,92640	40

TABLE V.

Rate per cent	Half yearly payments.	Quarterly payments.
3	1.007445	1.011181
3½	1.008675	1.013031
4	1.009902	1.014877
4½	1.011126	1.016720
5	1.012348	1.018559
5½	1.013567	1.020395
6	1.014781	1.022257
6½	1.015993	1.024055
7	1.017204	1.025880

The construction of this table, is from an algebraic theorem given by the learned A. De Moivre, in his *Treatise of Annuities on lives*, which may be in words, thus:

For half yearly payments, take a unit from the ratio, and from the square root of the ratio; ½ the quotient of the first remainder divided by the latter, will be the tabular number.

For quarterly payments, use the fourth root as above, and take ¼ of the quotient.

CASE 1.

The annuity, time, and rate of interest given, to find the amount.

RULE.

Take an unit from the ratio for a divisor, and from the ratio involved to the time for a dividend; the quotient, multiplied by the annuity, will be the amount for yearly payments; Or,
By Table III.

Multiply the number under the rate, and opposite to the time, by the annuity, and the product will be the amount for yearly payments.

If the payments be half yearly, or quarterly, the amount for the given time, found as above, multiplied by the proper number in Table V. will be the true amount.

EXAMPLES.

1. What will an annuity of 30*l.* per annum, payable yearly, amount to in four years, at 5 per cent. per annum, and what would be the respective amounts, if the payments were to be half yearly or quarterly?

$$1.05 - 1 = .05$$

$$1.05 \times 1.05 \times 1.05 \times 1.05 - 1 = .21550625$$

$$\begin{array}{r} \text{Same as No. 4, Table III.} \\ 4.310125 \\ \hline 30 \end{array}$$

Amount for yearly payments £. 129.30375; which
× 1.012348, from Table V. = 130.9004, for half yearly.
Or, × 1.018559, from do. = 131.7035, for quarterly payments.

2. How much will a pension of 50*l.* per annum amount to in 5 years at 4 per cent. ? *Ans.* 270*l.* 16*s.* 3*d.* 45.

3. If a yearly rent of 96 *dols.* be in arrears for 7 years, at 6 per cent. what will it amount to ? *Ans.* 805.808352 *dol.*

4. If a salary of 84 *dol.* per annum, be unpaid for 6 years, what is the amount at 5*½* per cent. ? *Ans.* 578.596284 *dol.*

5. What would 24 *dols.* a year, payable half yearly, amount to in 9 years at five per cent. ? *Ans.* 267.905280294528 *dol.*

CASE 2.

The amount, rate, and time given, to find the annuity ;

RULE.

Take an unit from the ratio involved to the time, for a divisor, and multiply the amount by the ratio, less one, for a dividend ; the quotient will be the annuity.

Or,—By Table III.

Divide the amount by the number under the ratio, and opposite to the time ; the quotient will be the annuity.

When the payments are half yearly, or quarterly, divide the annuity so found, by the proper number in Table V.

EXAMPLES.

1. What annuity, being unpaid for 4 years, will amount to 129*l.* 6*s.* 0*d.* .6 at 5 per cent. ?

$$\text{Amount} = 129.30375$$

1.05

£.

$$1.05 \times 1.05 \times 1.05 \times 1.05 - 1 = .21550625) 6.46518780 (30$$

6.4651875 *Ans.*

2080

By Table III. 4.310125) 129.303750 (30*l.* yearly.

Table V. 1.012348) 30. (29.6341 half yearly. Or,

Ditto. 1.011559) 30. (29.4534 quarterly.

2. If a pension foreborne 5 years, amount to 270*l.* 16*s.* 3*d.* .456 at 4 per cent. how much is it per annum ? *Ans.* 50*l.*

3. How much per annum, at six per cent. will amount to 805 *dol.* 80 *cts.* 1.352 *m.* in 7 years ? *Ans.* 96 *dol.*

4. The payment of a salary was omitted for six years, and then the amount at 5*½* per cent. found to be 578.596284 *dols.* how much was it per annum ? *Ans.* 84 *dols.*

5. What annuity payable half yearly, would amount to 2679.05280294528 *dol.* in 9 years at 5 per cent. ? *Ans.* 24 *dol.*

CASE 3.

The annuity, amount, and rate of interest given, to find the time ;

RULE.

Multiply the amount by the ratio less one ; divide the product by the annuity, and add an unit to the quotient ; then involve the ratio up to the sum, and the power to which it is raised will indicate the time. Or,

Find the said sum in Table II. under the rate, and against it, in the column of years, will be the time required.

Note. If the sum be not an even yearly power, work as per Note to Case 4, page 158.

EXAMPLES.

1. In what time will 30*l.* per ann. amount to 129*l.* 6*s.* 0*d.* .6, allowing compound interest at 5 per cent. ?

$$\pounds. 129 \quad 6 \quad 1\frac{3}{4}.6 = 129.30375$$

$$\text{Ratio } 1.05 - 1 = .05$$

$$\text{Annuity } 3,0)6.4651875$$

Quotient $+ 1 = 1.21550625$; then

$1.05 \times 1.05 \times 1.05 \times 1.05 = 1.21550625 =$ the 4th power of the ratio, indicating 4 years for the answer.

2. In what time will 50*l.* per annum, amount to 270*l.* 16*s.* 3*d.* .456 at 4 per cent. ? *Ans.* 5 years.

3. In what time will the yearly rent of a house at 96 dol. per annum, amount to 805 dol. 80 cts. 8.352*m.* at 6 per cent. ?

Ans. 7 years.

4. In what time will a salary of 84 dol. per annum, amount to 578.596284 dol. at $5\frac{1}{4}$ per cent. ? *Ans.* 6 years.

CASE 4.

The annuity, the time and rate given, to find the present worth ;

RULE.

Divide the annuity by the ratio involved to the time, and subtract the quotient from the annuity, divide the remainder by the ratio less one ; and the quotient will be the present worth ; Or

By Table IV.

Multiply the number under the rate, and opposite the time by the annuity, and the product will be the present worth.

When the payments are half yearly or quarterly, multiply the present worth so found, by the proper number in Table V.

EXAMPLES.

1. What is the present worth of 20*l.* a year for 6 years, payable either yearly, half yearly, or quarterly, computing at 5 per cent. per annum?

$$\begin{array}{r} \text{£. 2.0} \\ \hline | \text{---} |^6 = 1.3400956 \times 20. (14.924308 \\ \hline \text{.05) } 5.075692 \end{array}$$

Or, by Table IV. $5.07569 \times 20 = 101.5138$ *l.* = the present worth for yearly payments; then by table V.

$101.5138 \times 1.012348 = \text{£. } 102.7673$, for half yearly.

$101.5138 \times 1.018559 = \text{£. } 103.3978$, for quarterly.

2. What is the present worth of an annuity of 30*l.* per annum, to continue 5 years at 4 per cent.?

Ans. 133*l.* 11*s.* 1.104*d.*

3. What ready money will purchase an annuity of 415.8125 *dol.* to continue 4 years at 6 per cent.?

Ans. 1440.83189375 *dol.*

4. If the yearly rent of an estate be 588.865 *dol.* what sum will purchase it for 4 years, at $5\frac{1}{2}$ per cent.?

Ans. 2064.0542661 *dol.*

CASE 5.

The present worth, time, and ratio given to find the annuity;

RULE.

Multiply the ratio involved to the time, the ratio less 1, and the present worth together for a dividend; take an unit from the ratio involved to the time for a divisor, the quotient will be the annuity. Or,

By Table IV.

Divide the present worth by the number for the rate and time, and the quotient will be the annuity.

When the payments are half yearly, or quarterly, use table V. as at case 2d.

EXAMPLES.

1. What annuity, payable yearly, half yearly, or quarterly, for 6 years, may be purchased for 101*l.* 10*s.* 3*d.* at 5 per cent. per annum, compound interest?

$$\begin{array}{r|l}
 6 & \\
 \hline
 1.05 & = 1.340096 \\
 & .05 \\
 \hline
 & .06700480 \\
 & 415.101 \text{ inverted}
 \end{array}$$

By table IV. $\left\{ \begin{array}{l} 101.514 \\ \text{Dividend by} \\ 5.07569 \\ \text{Equal } 20\text{.} \end{array} \right.$

$$\begin{array}{r}
 670048 \\
 6700 \\
 3350 \\
 67 \\
 27
 \end{array}$$

$\begin{array}{l} .340096 \times 6.801920 (20\text{.} \text{ yearly.} \\ \text{then } 20\text{.} \div \left\{ \begin{array}{l} 1.012348 = 19.7561 \text{ half yearly.} \\ 1.018556 = 19.6356 \text{ quarterly.} \end{array} \right. \end{array} \quad \left. \begin{array}{l} \\ \\ \end{array} \right\} \text{Ans.}$

2. What annuity for 5 years will 139*l.* 11*s.* 1.104*d.* present money, purchase at 4 per cent. ? Ans. 30*l.*

3. What annuity for 4 years, will 1440.83189375 dollars, present money, purchase at 6 per cent. ? Ans. 415.8125 dol.

4. What annuity for 4 years, will 2064.0542661 dol. present money, purchase at 5*½* per cent. ? Ans. 588.865 dol.

CASE 6.

The annuity, present worth, and ratio given, to find the time;

RULE.

Multiply the present worth by the ratio less one, subtract the product from the annuity, and divide the annuity by the

remainder; then involve the ratio till it equals (or nearly equals) the quotient, and the power to which it is raised will indicate the time. Or,

Find the quotient in Table II. under the rate, and against it, in the left column, stands the time

EXAMPLES

1. How long may a lease of 20*l.* yearly rent be possessed for 101*l.* 10*s.* 3*d.* down, allowing 5 per cent. per annum to the purchaser?

$$101.51458 = \text{present worth.}$$

$$.05 = \text{Ratio} - 1$$

$$\begin{array}{r} 5.0757290 \\ 20. \end{array}$$

6

$$14.924271) 20.000000 (1.34009 = 1.05|$$

indicating 6 years for the *Ans.*

2. For what time will 133*l.* 11*s.* 1*d.* purchase a lease of 30*l.* a year, at 4 per cent.?

Ans. 5 years.

3. If 1440.83189375 dollars be paid down for a lease of 415.8125 *dols.* per annum, at 6 per cent. for what time is the purchase made?

Ans. 4 years.

4. If a house be let for 588.865 *dol.* per annum, and the lessee make present payment of 2064.0542661 *dol.* at 5½ per cent. for what time is the lease purchased?

Ans. 4 years.

ANNUITIES, &c. IN REVERSION.

CASE 1.

Given the annuity, time of reversion, time of continuance, and rate given, to find the present worth;

RULE.

Divide the annuity by the ratio involved to the time of continuance, and subtract the quotient from the annuity for a dividend; multiply the ratio involved to the time of reversion by the ratio less 1, for a divisor; the quotient of this division will be the present worth, Or,

Take two numbers under the given rate in Table IV. viz. that opposite the sum of the two given times, and that against the time of reversion, and multiply their difference by the annuity for the present worth.

When the payments are half yearly or quarterly, use Table V. as at Case 4th of annuities, page 165.

EXAMPLES.

1. What is the present worth of a lease of 20*l.* per annum, to continue 4 years, but not to commence till the end of two years, allowing 5 per cent. to the purchaser?

$$\begin{array}{r} \text{4} \\ \hline 1.05 | = 1.215506 \end{array} \begin{array}{r} \text{£. 20} \\ 20.00000 \end{array} \begin{array}{r} (16.45405 \\ \hline \end{array}$$

$$\begin{array}{r} \text{2} \\ \hline 1.05 | \times .05 = .055125 \end{array} \begin{array}{r} 3.54595 \\ \hline \end{array} \begin{array}{r} (64.326 \text{ Ans.} \\ \hline \end{array}$$

$$\begin{array}{r} \text{From table IV. for } \left\{ \begin{array}{l} 6 \text{ years} = 5.07569 \\ 2 \quad \quad = 1.85941 \end{array} \right. \\ \hline 3.21628 \\ 20 \\ \hline \end{array}$$

Ans. 64.32560 as before.

2. What is the present worth of 76.8 dol. per annum, to continue 7 years, but not to commence till 4 years hence, allowing 5 per cent. to the purchaser? *Ans.* 365.605dol.

3. A house which is now building, is proposed to be let for 8 years, at 240dol. per annum, but cannot be finished till the end of two years; what is the present worth of such a lease, allowing 4 per cent. for present payment? *Ans.* 1493.955dol.

CASE 2.

The present worth, time, and ratio given, to find the annuity;

RULE.

Involve the ratio to the years from the time of purchase to the expiration of the annuity for a dividend, and from the ratio involved to the time of continuance, take one for a divisor; the quotient multiplied by the present worth and the ratio less one, gives the annuity. Or,

Take two numbers from table IV. as in the preceding case, and divide the present worth by their difference.

When the payments are half yearly or quarterly, use table V. as at Case 2d. of annuities, page 163.

EXAMPLES.

1. What annuity or yearly rent to be entered upon 2 years hence, and then to continue 4 years, may be purchased for 64*l.* 6*s.* 6½*d.* ready money, at 5 per cent.?

$$\begin{array}{r} 4 \qquad \qquad \qquad 6 \\ \hline 1.05|-1=.2155062)1.3400956=1.05|)6.21836 \\ \text{Present worth inverted } 623.46 \end{array}$$

$$\begin{array}{r} \text{Product } 400.001 \\ \hline .05 \end{array}$$

£. 20.00005 *Ans.*

From table IV. $\left\{ \begin{array}{l} 5.07569 \text{ for 6 years.} \\ 1.85941 \text{ for 2 years.} \end{array} \right.$

Difference 3.21628)64.326(20*l.* *Ans.*

2. A lease of certain lands is in being for 4 years yet to come, and another given for 7 years, to commence when the former is expired, on condition that 365.605*dol.* be paid immediately; what is the yearly rent of said lands, allowing 5 per cent. for present payment? *Ans.* 76.8*dol.*

3. The present payment for the lease of a house is 1493.955*dol.* the lease to commence 2 years hence, and to continue 8 years; how much is the yearly rent, when 4 per cent. is allowed for present money? *Ans.* 240*dol.*

CASE 3.

The present worth, annuity, rate of interest and time of reversion given, to find the time of continuance;

RULE.

Subtract the continued product of the ratio involved to the time of reversion, the ratio less one and the present worth, from the annuity, and divide the annuity by the remainder.

Then involve the ratio till it (nearly) equals the quotient, and the power will indicate the time required. Or,

Find the said quotient in Table II. under the rate, and against it stands the time.

EXAMPLES.

1. A lease of 20*l.* per annum to commence 2 years hence, worth 64*l.* 6*s.* 6½*d.* ready money, for what time must it continue, when 5 per cent. per annum is allowed to the purchaser?

2

20 annuity.

$$1.05^2 \times .05 \times 64.326 = 3.54597$$

$$16.45403 \div 20 = 1.215506$$

which is the fourth power of the ratio, indicating 4 years for the answer.

2. For a lease of 768*l.* per annum, which is not to commence till the expiration of 4 years, a purchaser lays down 365.605*l.* being the present worth at 5 per cent. how long is he to possess the premises?

Ans. 7 years.

3. The yearly rent of 240*l.* to commence 2 years hence, is sold at 4 per cent. for 1493.225*l.* how long is it to continue?

Ans. 8 years.

PERPETUITIES

PERPETUITIES are perpetual annuities, or such as continue for ever.

Note. For perpetual, half-yearly, or quarterly payments, table V. is to be applied as in the similar cases of temporary annuities foregoing.

CASE 1.

The annuity and ratio given, to find the present worth

Perpetuities.

RULE.

Divide the annuity by the ratio less 1, the quotient will be the present worth.

EXAMPLES.

1. What sum will purchase a freehold estate of 40*l.* per annum, calculating at 5 per cent. and supposing the payments either yearly, half yearly, or quarterly?

$$\begin{aligned} & 1.05 - 1 = .05 \quad 40 \text{ (800*l.* if yearly;} \\ \text{then, } 800 \times \left\{ \begin{array}{l} 1.012348 = 809.8784 \text{ if half yearly;} \\ 1.013559 = 814.8472 \text{ if quarterly.} \end{array} \right. \end{aligned}$$

2. What is the present worth of an estate in fee simple of 3426 *dol.* per annum, allowing 4 per cent. to the purchaser?

Ans. 85650 *dol.*

CASE 2.

The present worth, and ratio given, to find the annuity;

RULE.

Multiply the present worth, by the ratio less one, the product will be the annuity.

EXAMPLES.

1. A freehold estate bought for 800*l.* ready money, at 5 per cent. what is the annuity?

$$\begin{array}{r} \text{£.} \\ 800 \\ 1.05 - 1 = .05 \\ \hline \end{array}$$

Ans. 40.00*l.*

2. If an estate be sold for 85650*dol.* present money, and 4 per cent. be allowed to the buyer; how much is the income per annum?

Ans. 3426 *dol.*

CASE 3.

The present worth and annuity given, to find the ratio;

RULE.

Divide the sum of the present worth and annuity, by the present worth; the quotient will be the ratio.

EXAMPLES

1. If a real estate of 40*l.* per annum be sold for 800*l.* what is the rate per cent. ? *Ans.* 5*l.* per cent.

$$\begin{array}{r} 800 \\ 40 \\ \hline \end{array}$$

800)840(1.05 = the ratio of 5 per cent.

2. If a freehold estate of 696 *dol.* per annum, be bought for 17400 *dol.* the rate per cent. is required. *Ans.* 4 per cent.

CASE 4.

The ratio given to find the year's purchase;

RULE.

Divide an unit by the ratio less one, and the quotient will be the year's purchase.

EXAMPLES.

1. How many years purchase should a gentleman offer for a perpetuity, to have 6 per cent. for his money?

.06)1.00(16 $\frac{2}{3}$ years, *Ans.*

2. In selling a freehold estate at 8 per cent. how many years purchase does it bring? *Ans.* 12 $\frac{1}{2}$.

CASE 5.

The year's purchase given to find the ratio.

RULE.

By the year's purchase divide the same more one, and the quotient will be the ratio.

EXAMPLES.

1. Bought a ground rent for 15 years purchase : what rate per cent. was allowed in this contract ?

15)16.00(1.0666, &c. = $6\frac{2}{3}$ per cent. *Ans.*

2. What rate of interest is allowed in selling a perpetuity at 20 years purchase ? *Ans.* 5 per cent

PERPETUITIES IN REVERSION.

CASE 1.

The rent of a freehold estate, time of reversion, and rate per cent. given, to find the present worth ;

RULE.

Multiply the ratio involved to the time of reversion, by the ratio, less one, for a divisor ; by which divide the yearly payment, and the quotient will be the present worth.

EXAMPLES.

1. Suppose a freehold estate of 60*l.* per annum, to commence 2 years hence, be put up to sale ; what is the value, allowing the purchaser 6 per cent. ?

$$1.06 \times 1.06 \times .06 = .067416$$

£. £. s. d.

.067416)60(889 19 11 *Ans.*

2. What is an estate of 696 *dol.* per annum, to continue for ever, but not to commence till the expiration of 4 years, worth in present money, allowance being made at 4 per cent. ?

Ans. 14873.595 *dol.*

CASE 2.

The present worth of a perpetuity, time of its reversion, and rate per cent. given, to find the yearly payment ;

RULE.

The continual product of the present worth, the ratio involved to the time of reversion, and the ratio, less one, will be the salary.

EXAMPLES.

1. A freehold estate is bought for 889.9965*l*. which does not commence till the end of two years; the purchaser being allowed 6 per cent. for his money; what was the yearly income?

$$\begin{array}{l} \text{Present worth 889.9965} \\ 1.06 \times 1.06 \times .06 = .067416 \end{array} \left. \vphantom{\begin{array}{l} \text{Present worth 889.9965} \\ 1.06 \times 1.06 \times .06 = .067416 \end{array}} \right\} \text{Multiplied.}$$

£. 60 Ans. nearly.

2. There is a freehold estate bought for 14873.595 dol. which does not commence till the expiration of four years; the buyer was allowed 4 per cent. for his money; what was the yearly income?

Ans. 696 dol.

LIFE ANNUITIES.

ANNUITIES for Lives are estimated by probabilities drawn from the usual period of human life, according to observations made by men of eminence on regular bills of mortality.

Construction of the following Table.

With the rate per cent. and complement of the given age to 86, take a number from table IV. multiply it by the ratio, and take the product from the said complement for a dividend; multiply the complement by the ratio, less one, for a divisor; the quotient will be the tabular number.

EXAMPLES.

To find the tabular number for 50 years at 5 per cent.

86—50=36, which in table IV. with 5 per cent.

give 16.5468

1.05

$$\begin{array}{r} 36 \quad 17.374140 \\ .05 \quad 36 \end{array} \left. \vphantom{\begin{array}{r} 36 \quad 17.374140 \\ .05 \quad 36 \end{array}} \right\} \text{Subtract.}$$

1.80)18.62586(10.3477 Facit.

Table VI. Value of *£* or dol. annuity for a single life

Age.	3 p. ct.	3½ p. ct.	4 p. ct.	4½ p. ct.	5 p. ct.	6 p. ct.
9 or 10	18,87	18,27	16,88	15,67	14,60	12,80
8 or 11	19,74	18,16	16,79	15,59	14,53	12,75
7 or 12	19,60	18,05	16,64	15,51	14,47	12,70
13	19,47	17,94	16,60	15,43	14,41	12,65
6 or 14	19,33	17,82	16,50	15,35	14,34	12,60
15	19,19	17,71	16,41	15,27	14,27	12,55
16	19,05	17,59	16,31	15,19	14,20	12,50
5 or 17	18,90	17,46	16,21	15,10	14,12	12,45
18	18,76	17,33	16,10	15,01	14,05	12,40
19	18,61	17,21	15,99	14,92	13,97	12,35
4 or 20	18,46	17,09	15,89	14,83	13,89	12,30
21	18,30	16,96	15,78	14,73	13,81	12,20
22	18,15	16,83	15,67	14,64	13,72	12,15
23	17,99	16,69	15,55	14,54	13,64	12,10
3 or 24	17,83	16,56	15,43	14,44	13,55	12,00
25	17,66	16,42	15,31	14,34	13,46	11,95
26	17,50	16,28	15,19	14,23	13,37	11,90
27	17,33	16,13	15,04	14,12	13,28	11,80
28	17,16	15,98	14,94	14,02	13,18	11,75
29	16,99	15,83	14,81	13,90	13,09	11,65
30	16,80	15,68	14,68	13,79	12,99	11,60
2 or 31	16,62	15,53	14,54	13,67	12,88	11,50
32	16,44	15,37	14,41	13,55	12,78	11,40
34	16,06	15,05	14,12	13,30	12,56	11,25
36	15,67	14,71	13,82	13,04	12,39	11,05
38	15,29	14,34	13,52	12,77	12,09	10,90
1 or 39	15,05	14,16	13,36	12,63	11,96	10,80
40	14,84	13,93	13,20	12,48	11,83	10,70
42	14,41	13,59	12,85	12,18	11,57	10,45
44	13,96	13,20	12,50	11,87	11,29	10,25
46	13,49	12,78	12,13	11,54	10,99	10,00
48	13,01	12,36	11,74	11,19	10,68	9,75
50	12,51	11,92	11,34	10,82	10,35	9,45
52	12,00	11,45	10,92	10,44	9,99	9,20
54	11,46	10,95	10,47	10,04	9,63	8,85
56	10,90	10,44	10,01	9,61	9,24	8,55
58	10,32	9,91	9,52	9,16	8,83	8,20
60	9,73	9,36	9,01	8,69	8,39	7,80
62	9,11	8,79	8,48	8,19	7,93	7,40
64	8,46	8,19	7,92	7,67	7,43	6,95
66	7,79	7,56	7,33	7,12	6,91	6,50
68	7,10	6,91	6,75	6,54	6,36	6,00
70	6,39	6,22	6,06	5,92	5,77	5,50
72	5,63	5,51	5,38	5,28	5,15	4,90
74	4,85	4,77	4,66	4,57	4,49	4,30
76	4,05	3,98	3,91	3,84	3,78	3,65
78	3,21	3,16	3,11	3,07	3,03	2,95
80	2,34	2,31	2,28	2,26	2,23	2,15

CASE 1.

To find the present worth of an annuity for a single life of a given age;

RULE.

Multiply the value of 1*l.* or dol. for the given age and rate of interest, in table VI. by the annuity.

EXAMPLES.

1. What sum should a person of 50 years of age give for an annuity of 100*l.* per annum, during his life, reckoning interest at $4\frac{1}{2}$ per cent.?

Tabular number $10.82 \times 100 = 1082*l.*$ *Ans.*

2. A merchant who married a widow of 40, would sell her jointure of 786 dol. a year, for ready money; what should it bring at $3\frac{1}{2}$ per cent.?

Ans. 10988.28 dol.

CASE 2.

To find the value of an annuity for the joint continuance of two lives, one life failing, the annuity to cease.

RULE.

Multiply the product of the 2 tabular numbers for the given ages by the ratio less one, and deduct this result from the sum of those numbers for a divisor; multiply the first product by the annuity for a dividend; the quotient will be the value required.

EXAMPLES.

1. What is the value of 70*l.* annuity for the joint lives of 2 persons, one of 40 and the other of 50 years of age, reckoning interest at 5 per cent.?

$$11.83 \times 10.35 = 122.4405$$

.05

$\times 70$

$\div 122025$

$$11.83 \times 10.35 = 22.18$$

$16.057975 \times 8570.835 = 533.7*l.*$ *Ans.*

2. What is 240 dollars annuity worth for the joint lives of 2 persons of the age of 30 years each, at 4 per cent.?

Ans. 2493.7 dol. +

CASE 3.

To find the value of an annuity upon the longest of 2 lives; that is to continue as long as either of the persons shall be living.

RULE.

Subtract the value of the joint lives [found by Case 2d.] from the sum of the values of the single lives, the remainder will be the value sought.

EXAMPLES.

1. What is the value of 70*l.* annuity for the longer life of two persons whose ages are, one 40 the other 50 years, interest at 5 per cent.?

$$11.83 + 10.35 = 22.18$$

70

$$1552.60$$

Joint lives = 533.7, per Case 2d.

$$\text{Ans. } 1018.9\textit{l.}$$

2. What is 100 *dol.* annuity worth, at 4 per cent. to continue during the lives of two persons whose ages are 30 and 40 years?

Ans. 1826 *dol.*

CASE 4.

To find the value of an annuity for the time which a person of a given age may happen to survive another, whose age is also given.

RULE.

From the value of 1*l.* or *dol.* for the proposed successor's life, subtract the value thereof for his and the possessor's joint lives, and multiply the remainder by the annuity for the present worth.

EXAMPLES.

1. A enjoys an income of 100*l.* per annum; and B would purchase it for his life after A's death; what is B's chance worth, reckoning interest at 5 per cent. their ages being A 60 B 25?

1*l.* for B's life, Table VI. 13.46

The joint value of 1*l.* 6.97, by case 2d.

$$6.49 \times 100 = 649\textit{l. Ans.}$$

2. A gentlewoman of 54 years of age, possesses an estate worth 120 dollars per annum clear, which at her death falls to her son, who is now 25, if he shall then be living; what is the value of his expectation at 5 per cent.?

Ans. 679.2 *dol.*

Note. Other cases might be added; but these adduced are the most useful, and will perhaps be sufficient.

ARITHMETICAL PROGRESSION.

ARITHMETICAL Progression is a rank, or a series of numbers, which increase or decrease by a common difference: In which five particulars are to be observed, viz.

First, The first term;

Secondly, The common excess, or difference;

Thirdly, The last terms;

Fourthly, The number of terms;

Fifthly, The sum of all the terms.

Note. In any series of numbers in Arithmetical Progression, the sum of the two extremes will be equal to the sum of any two terms equally distant therefrom; as, 2, 4, 6, 8, 10, 12; where $2+12=14$; so $4+10=14$; and $6+8=14$; or, 3, 6, 9, 12, 15, where $3+15=18$; also $6+12=18$; and $9+9=18$.

CASE 1.

The first term, common difference, and number of terms given, to find the last term, and sum of all the terms.

RULE.

First, Multiply the number of terms, less one, by the common difference, and to that product add the first term, the sum is the last term.

Secondly, Multiply the sum of the first and last term by the number of terms, and half the product will be the sum of the series.

EXAMPLES.

1. Bought 19 yards of shalloon, at 1 cent for the first yard, 3 cents for the second, 5 cents for the third, &c. increasing 2 cents every yard, what did they amount to?

$$19-1=18$$

$$1+37=38$$

2

19 number of terms.

36

342

+ 1

38

The last term, 37

2)722

3.61 sum of the terms = 3 dol.

61 cts. *Ans.*

2. Sixteen persons bestowed charity to a poor man; the first gave 3 cents, the second 9 cents, and so on in arithmetical pro-

gression; what did the last person give, and what sum did the indigent person receive?

Ans. the last gave 65 cts.—sum received 5 dol 60 cts.

3. A merchant sold 100 yards of cloth; for the first yard he received 10 cents, for the second 20 cts. for the third 30 cts. &c. what sum did he receive?

Ans. 505 dol.

4. Admit 100 stones were laid two yards distant from each other in a right line, and a basket placed two yards from the first stone; what distance must a person travel, to gather them singly into the basket?

Ans. 11M. 3fur. 180yds.

5. Sold 54 yds. of cloth; the price of the first yard was 20 cents, of the second 50 cents, &c. what was the price of the last yard, and the sum for all?

Ans. { the last yard, 16 dol. 10 cts.
whole sum, 440 dol. 10 cts.

6. H. covenanted with K. to serve him 14 years, and to have 5*l.* the first year, and his wages to increase annually 2*l.* during the term; what had he the last year, what on an average yearly, and what for the whole time?

Ans. { 31*l.* the last year.
18*l.* annually.
252*l.* whole time.

CASE 2.

When the two extremes and number of terms are given, and the common difference of all the terms required;

RULE.

Divide the difference of the first and last term by the number of terms, less one, the quotient will be the common difference.

EXAMPLES.

1. Admit a debt to be discharged at 16 several payments in arithmetical progression; the first to be 14*l.* the last 100*l.* what is the common difference, and what each payment, and the whole debt?

$$\begin{array}{rcl} & \text{£.} & \text{s.} & \text{d.} \\ 100 - 14 = 5 & 14 & 8 & \text{common difference.} \end{array}$$

$$\begin{array}{rcl} 16 - 1 & 14 & 0 & 0 \text{ the first payment.} \end{array}$$

$$\begin{array}{rcl} & 19 & 14 & 8 = \text{second.} \end{array}$$

$$\begin{array}{rcl} & 25 & 9 & 4 = \text{third, \&c.} \end{array}$$

$$14 + 100 \times 8 = 912\text{i} \text{ the whole debt.}$$

2. A man had 10 sons, whose several ages differed alike; the youngest was three years old, and the eldest 48; what was the common difference of their ages? *Ans.* 5 years.

3. There are 21 persons, whose ages are equally distant from each other; the youngest is 20 years old, and the eldest 60; what is the common difference of their ages, and the age of each person? *Ans.* common difference 2 years.

20 the age of the first person.

$20 + 2 = 22$ of the second.

$22 + 2 = 24$ of the third, &c.

4. A footman is to travel from Philadelphia to a certain place in 19 days, and to go but 6 miles the first day, increasing every day by an equal excess, so that the last day's journey may be 60 miles; what is the common difference, and distance of the journey?

Ans. { Common difference 3 miles.
Distance 627 do.

GEOMETRICAL PROGRESSION.

GEOMETRICAL Progression is a series of numbers increasing or decreasing by one continual multiplier or divisor called the ratio; as 2, 4, 8, 16, 32, &c. increase by the continual multiplication of 2; and 32, 16, 8, 4, 2, decrease continually by the divisor 2, &c.

The last term and sum of the series are found by this

RULE.

Raise such a power of the ratio, multiplied into the first term, as is indicated by the number of terms for the last term. Or,

Note 1. Take a convenient number of terms (called indices) in Arithmetical Progression, beginning and increasing with an unit, under which, place the leading terms in the given Geometrical Progression: then the square of any term under an indice, will be the term represented by double that indice, &c.

2. If the first term and ratio be different, begin the indices with a cypher; then the square of any geometrical term, divided by the first term, will be one more than the term represented by double that indice, &c.

3. When a geometrical term is squared, the number of decimal figures, or cyphers to the right hand must remain the same as in the geometrical term. Then to find the sum of all the terms, multiply the last term by the ratio; from the product, subtract the first term, and divide the remainder by the ratio, less one; the quotient will be the sum of all the terms.

Or shorter, thus:

Involve the ratio to the power indicated by the number of terms; from which subtract one; divide the remainder by the ratio less one; and multiply the quotient by the first terms; the product will be the sum of the series.

EXAMPLES.

1. Sold 24 yards of Holland, at 2 cents for the first yard, 4 cents the second, 8 cents the third, &c. in a duplicate proportion; how much do they amount to?

1 2 3 4 indices
2 4 8 16 leading terms
16

256 8th term.
256

65536 16th do.
256

16777216 24th last term.
2 ratio.

33554432
2 first term.

33554430 sum of the series = 335544

dol. 30 cts. Ans.

2. Bought 30 bushels of wheat; the first bushel for 2 cents, the second 4 cts. the third 8 cts. doubling the price of each preceding bushel for that of the next; query the amount, and price per bushel at an average?

Ans. { 21474836 dol. 46 cts. amount.
715827 dol. 88 cts. + per bushel.

3. Sold 15 yards of satin, the first yard for 10 cts. the second for 20 cts. the third for 40 cts. &c. what sum did they amount to?

Ans. 3276 dol. 70 cts.

4. Admit a goldsmith sold 1lb. of gold, at 1 mill for the first ounce, four mills for the second, sixteen mills for the third, &c. in a quadruple proportion; what did it amount to, and what did he gain by it, supposing it cost him 10 dol. 68 cts. per ounce?

Ans. { 5592 dol. 40 cts. 5m. Sold for.
5464 dol. 24 cts. 5m. Gained.

5. What sum would purchase a horse with 4 shoes, and 8 nails in each shoe, at 1 mill for the first nail, two mills for the second, four mills for the third, &c. doubling to the last?

Ans. 4294967 dol. 29 cts. 5m.

6. Suppose a man wrought 20 days, and received for the first day 4 barley corns, for the second 12, for the third 36, &c. in triple proportion; what did the 20 days labour come to, rating the barley at 30 cents per bushel?

Ans. 4256 dol. 10 cts.

Note. 7680 wheat or barley corns, are supposed to make a pint.

7. Sold 30 yards of velvet, at 2 pins for the first yard, 6 for the second, 18 for the third, &c. and these disposed of at one mill per hundred; how much did the velvet amount to? And whether did the seller gain or lose, and how much, supposing the prime cost of the velvet at 133 dol. 34 cts. per yard?

Ans. { 2058911320 dol. 94 cts. 6m. Amount;
2058907320 dol. 74 cts. 6m. Gain.

8. A certain person married his daughter on new year's day, and gave her one guinea towards her portion, promising to double it on the first day of every month, for one year; what was her portion in sterling money?

Ans. 4299l. 15s.

ALLIGATION.

ALLIGATION is a rule for adjusting the prices and simples of compound quantities.

CASE 1.

When several simple quantities and their prices are given, and a mean price of any part of the compound is required.

RULE.

As the sum of the several quantities,
Is to their total value;
So is any part of the composition,
To its value.

EXAMPLES.

1. If 19 bushels of wheat at 6s. the bushel, 40 of rye at 4s. and 12 of barley, at 3s. be mixed together; what is a bushel of this mixture worth?

$$\begin{array}{r}
 B. \quad s. \\
 19 \text{ at } 6 = 114 \\
 40 \text{ at } 4 = 160 \\
 12 \text{ at } 3 = 36 \\
 \hline
 71 \quad) 310 \quad (4 \frac{4}{7} \text{ Ans.}
 \end{array}$$

2. A grocer mixed sugars; 2Cwt. at 56s. 1Cwt. at 43s. and 2Cwt. at 50s. per Cwt. what is 3Cwt. of this mixture worth?

Ans. 7l. 13s.

3. If 4oz. of silver worth 60 cts. the ounce, be melted with 8oz. at 48 cts. what is one ounce of this mixture worth?

Ans. 52 cts.

4. A wine merchant mixes 12 gallons of wine, at 58 cts. the gallon, with 24 gallons at 66 cts. and 16 at 75 cts. what is a gallon of this mixture worth?

Ans. 66 cts. +

5. A goldsmith melted together 8oz. of gold of 22 carats fine, 1lb. 8oz. of 21 carats fine, and 10oz. of 18 carats fine; what is the quality or fineness of this composition?

Ans. 20 $\frac{4}{7}$ carats fine.

6. A refiner melted 5lb. of silver bullion of 8oz. fine, with 10lb. of 7oz. and 15lb. of 6oz. fine, of what fineness is 1lb. of this mass?

Ans. 6oz. 13dwt. 8gr. fine.

CASE 2.

When the prices of several simples are given, to find how much of each, at their respective rates, must be taken to make a compound at any proposed price.

RULE.

Write the rates of the simples under each other; link each rate, which is less than the mean rate, with one or more that is greater; the difference, or sum of the differences, between each rate, and the mean price placed opposite to the respective rate or rates with which it is linked, will be the several quantities required.

Note 1. If all the given prices be greater, or less than the mean rate, they must be linked to a cypher.

2. Different modes of linking, will produce different answers.

EXAMPLES.

1. How much rye at 48 cts. per bushel, barley at 36 cts. and oats at 24 cts. will make a mixture worth 30 cts. the bushel?

$$\text{Mean rate } 30 \left\{ \begin{array}{l} 48 \\ 36 \\ 24 \end{array} \right. \quad \begin{array}{l} 6 \text{ at } 48 \\ 6 \quad 36 \\ 18+6=24 \quad 24 \end{array} \left. \vphantom{\begin{array}{l} 48 \\ 36 \\ 24 \end{array}} \right\} \text{Ans.}$$

2. Canary at 24 cts. a quart, Sherry at 16 cts. and Malaga at 12 cts. how much of each must be taken, that the mixture may be worth 18 cts. the quart?

$$\text{Answer.} \left\{ \begin{array}{l} 8 \text{ quarts of Canary,} \\ 6 \quad \text{Sherry, and} \\ 6 \quad \text{Malaga.} \end{array} \right.$$

3. A grocer has several sorts of tea, viz. at 12s. per lb at 11s. at 9s. and at 8s. how much of each sort must be taken to be sold at 10s. per lb.?

$$\begin{array}{lll} \text{lb. s.p.lb.} & \text{lb. s.p.lb.} & \text{lb. s.p.lb.} \\ 1 \text{ Ans. } \left\{ \begin{array}{l} 2 \text{ at } 12 \\ 1 \quad 11 \\ 1 \quad 9 \\ 2 \quad 8 \end{array} \right. & 2 \text{ Ans. } \left\{ \begin{array}{l} 3 \text{ at } 12 \\ 2 \quad 11 \\ 2 \quad 9 \\ 3 \quad 8 \end{array} \right. & 3 \text{ Ans. } \left\{ \begin{array}{l} 1 \text{ at } 12 \\ 2 \quad 11 \\ 2 \quad 9 \\ 1 \quad 8 \end{array} \right. \end{array}$$

$$\begin{array}{lll} \text{lb. s.p.lb.} & \text{lb. s.p.lb.} & \text{lb. s.p.lb.} \\ 4 \text{ Ans. } \left\{ \begin{array}{l} 1 \text{ at } 12 \\ 3 \quad 11 \\ 3 \quad 9 \\ 1 \quad 8 \end{array} \right. & 5 \text{ Ans. } \left\{ \begin{array}{l} 3 \text{ at } 12 \\ 1 \quad 11 \\ 3 \quad 9 \\ 2 \quad 8 \end{array} \right. & 6 \text{ Ans. } \left\{ \begin{array}{l} 2 \text{ at } 12 \\ 3 \quad 11 \\ 1 \quad 9 \\ 3 \quad 8 \end{array} \right. \end{array}$$

7 Ans. 3lb. of each sort.

4. How much sugar at 4 cts. at 6 cts. and at 11 cts. per lb. must be mixed together, so that the composition may be worth 7 cents per lb.?

Ans. 4 lb. of each sort.

5. It is required to mix several sorts of wine at 36 cts. 60 cts. and 84 cts. per gallon, with water, that the mixture may be worth 48 cts. per gallon; how much of each sort must the mixture be of?

Ans. 1 gal. wine at 36 cts. 1 do at 60 cts.
4 do. at 84 cts. and 3 gal. water.

CASE 3.

When the rate of all the simples, the quantity of one of them, and the compound rate of the whole mixture are given, to find the several quantities of the rest;

RULE.

Place the mean rate, and the several prices, and take their differences, as in case 2; then,

As the difference of the same name with the quantity given,
Is to the rest of the differences respectively ;
So is the quantity given,
To the several quantities required.

EXAMPLES.

1. A merchant has 40 lb., of tea, at 72 cents per lb. which he would mix with some at 68 cents, at 62 cents, and at 54 cents per lb.; how much of each sort must he take to mix with 40 lb. that he may sell the mixture at 65 cents per lb.?

$$65 \left\{ \begin{array}{l} 54 \rightarrow - 3 + 7 = 10 \\ 62 \rightarrow - 3 + 7 = 10 \\ 68 \rightarrow - 11 + 3 = 14 \\ 72 \rightarrow - 11 + 3 = 14 \end{array} \right. \text{against the price of the quantity given.}$$

$$\text{As } 14 \dots 40 :: \left\{ \begin{array}{l} 10 \dots 28\frac{1}{2} \text{ at } 54 \text{ cts. and } 62 \text{ cts. per lb.} \\ 14 \dots 40 \text{ at } 68 \text{ cts. per lb.} \end{array} \right. \text{Ans.}$$

2. How much barley at 30 cts. rye at 36 cents, and wheat at 48 cents per bushel, must be mixed with 12 bushels of oats at 18 cents per bushel, that the whole may rate at 22 cents per bushel?

Ans. 1 bushel of each.

3. How much gold of 16, 20, and 24 carats fine, and how much alloy must be mixed with 10 ounces of 18 carats fine, that the composition may be 22 carats fine?

Ans. 10 oz. of 16 carats fine, 10 of 20, 170 of 24, and 10 of alloy.

4. Ten bushels of wheat at 48 cents per bushel, with rye at 36 cents, barley at 24 cents, and oats at 12 cents, what quantity of these must be mixed with the wheat, to rate at 28 cts. per bushel?

$$1 \text{ Ans. } \left\{ \begin{array}{l} 2 \text{ bu. 2 p. of rye,} \\ 5 \text{ barley,} \\ 12 \text{ 2 oats.} \end{array} \right. \quad 2 \text{ Ans. } \left\{ \begin{array}{l} 40 \text{ bu. of rye,} \\ 50 \text{ barley,} \\ 20 \text{ oats.} \end{array} \right.$$

$$3 \text{ Ans. } \left\{ \begin{array}{l} 8 \text{ bu. of rye,} \\ 10 \text{ barley,} \\ 14 \text{ oats.} \end{array} \right. \quad 4 \text{ Ans. } \left\{ \begin{array}{l} 10 \text{ bu. of rye,} \\ 14 \text{ barley,} \\ 14 \text{ oats.} \end{array} \right.$$

$$5 \text{ Ans. } \left\{ \begin{array}{l} 12 \text{ bu. 2 p. of rye,} \\ 5 \text{ barley,} \\ 17 \text{ 2 oats.} \end{array} \right. \quad 6 \text{ Ans. } \left\{ \begin{array}{l} 2 \text{ bu. of rye,} \\ 14 \text{ barley,} \\ 10 \text{ oats.} \end{array} \right.$$

$$7 \text{ Ans. } \left\{ \begin{array}{l} 50 \text{ bu. of rye,} \\ 70 \text{ barley,} \\ 20 \text{ oats.} \end{array} \right.$$

CASE 4.

When the rates of the several simples, the quantity to be compounded, and the mean rate thereof are given, to find the quantity of each simple;

RULE.

Link the several prices, and place their differences as before; then,

As the sum of the differences,
Is to the quantity to be compounded;
So is the difference opposite to each rate,
To the required quantity of that price.

EXAMPLES.

1. A brewer had 3 sorts of beer, viz. at 10 cents, 8 cents, and 6 cents per gallon; how much of each sort must he take to make 30 gallons, worth 7 cents per gallon?

$$\begin{array}{rcl}
 7 \text{ cts. } \left\{ \begin{array}{l} 10 \\ 8 \\ 6 \end{array} \right\} & \begin{array}{l} - 1 \text{ As } 6 \dots 80 :: 1 \text{ to } 5 \text{ gal. at } 10 \text{ ct. \& } 8 \text{ ct.} \\ - 1 \quad 6 \dots 30 :: 4 \text{ to } 20 \quad \text{at } 6 \text{ cts.} \\ 3 + 1 = 4 \end{array} \\
 & \underline{\quad 6 \quad}
 \end{array}$$

2. A druggist compounds medicines, at 48 cents, 60 cents, and 96 cents per lb. to make two parcels, one of 21 lb. at 72 cts. the other of 35 lb. at 84 cts. per lb. what quantity of each must be taken?

$$\begin{array}{l}
 \text{Ans. } \left\{ \begin{array}{ll} 6 \text{ lb. at } 48 \\ 6 \quad 60 \\ 9 \quad 96 \end{array} \right\} = 21 \text{ lb. at } 72 \text{ cts. and } \left\{ \begin{array}{ll} 5 \text{ lb. at } 48 \text{ ct.} \\ 5 \quad 60 \text{ ct.} \\ 25 \quad 96 \text{ ct.} \end{array} \right\} \\
 \hspace{10em} = 35 \text{ lb. at } 84 \text{ cts. per lb.}
 \end{array}$$

3. A merchant had 4 sorts of coffee, at 8 cts. 12 cts. 18 cts. and 22 cts. per lb. the worst would not sell, and the best was too dear; he therefore concluded to mix 120 lb. what quantity of each must he take, so as to sell at 16 cts. per lb.?

Ans. 36 lb. at 8 cts. 12 at 12 cts. 24 at 18 cts. and 48 at 22 cts.

4. How many gallons of water must be mixed with wine at 48 cts. per gallon, so as to fill a vessel of 80 gallons, that may be afforded at 33 cts. per gallon?

Ans. 25 gallons of water with 55 of wine.

5. A goldsmith has gold of 15, 17, 20, and 22 carats fine, and would melt together of each so much, as to make a mass of 40 oz. of 18 carats fine; how much of each sort is necessary?

Ans. 16 oz. of 15, 8 of 17, 4 of 20, and 12 of 22 carats fine.

POSITION.

POSITION is a rule for finding an unknown number by one or more supposed numbers ; and is either single or double.

SINGLE POSITION.

SINGLE POSITION teaches to resolve such questions as require only one supposed number.

RULE.

Work with a supposed number, according to the tenor of the question ; then,

As the result of that operation,

Is to the supposed number ;

So is the number given,

To that required.

PROOF.

Work with the answer according to the tenor of the question, and the result must equal the given number.

Note. If the result of two or more supposed numbers be in the same proportion as the numbers supposed ; Or,

If upon working with two supposed numbers, and multiplying each of them by the result of the other, the products be equal, then the question may be solved by Single Position, otherwise not.

EXAMPLES.

1. A person after spending $\frac{1}{3}$ and $\frac{1}{4}$ of his money, had 60*l.* left ; what had he at first ?

$\begin{array}{ccccc} \text{£.} & \text{£.} & \text{£.} & \text{£.} & \text{£.} \\ \text{Suppose } 24 & \text{As } 10 \dots 24 :: 60 \dots 144 & \text{Ans.} \end{array}$

$$\frac{1}{3} = 8$$

$$\frac{1}{4} = 6$$

$$\frac{1}{4} = 14$$

Result 10

$$\frac{1}{3} = 48$$

$$\frac{1}{4} = 36$$

$$84$$

60 Proof.

2. B's age is $1\frac{1}{2}$ A's ; C's twice B's ; both with A's make 132 years ; how old is each of them ?

Ans. A 24, B 36, and C 72 years.

3. What sum is that, of which $\frac{1}{3}$, $\frac{1}{4}$, and $\frac{1}{5}$ make 74*l.*

Ans. 120*l.*

4. What sum of money at 6 per cent. per annum simple interest, will amount to 1200 dol. in ten years? *Ans.* 750 dol.

5. Three unequal vents will severally empty a vessel of 120 gallons in 1 hour, 2 hours, and 3 hours; if running together, what time is necessary? *Ans.* 32 min. 43 $\frac{7}{11}$ sec.

6. Of a certain sum given, A $\frac{1}{2}$, B $\frac{1}{4}$, C $\frac{1}{8}$, and D the rest, which is 67.2 dol. the sum is required? *Ans.* 268.8 dol.

7. What is the age of a person who says, that if $\frac{2}{3}$ of the years I have lived, be multiplied by 7, and $\frac{2}{3}$ of them be added to the product, the sum will be 292? *Ans.* 60 years.

8. Required the sum, the $\frac{1}{2}$, $\frac{1}{4}$, and $\frac{1}{8}$ of which make 941.

Ans. 1204

9. What sum at 6 per cent. per annum, will amount to 2064 dol. in 12 years? *Ans.* 1200 dol.

10. A person having about him a certain number of dollars, said that $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$, and $\frac{1}{16}$ of them would make 57; how many had he? *Ans.* 60 dol.

11. A schoolmaster being asked how many scholars he had, answered, if to double the number, I add $\frac{1}{2}$, $\frac{1}{4}$, and $\frac{1}{8}$ of them I shall have 338; how many had he? *Ans.* 108.

12. A saves $\frac{1}{3}$ of his income; but B, who has the same salary, by living twice as fast as A, sinks 120 dollars a year; how much then have they per annum? *Ans.* 360 dol.

13. The yearly interest of Charlotte's money at 6 per cent. exceeds $\frac{1}{10}$ of the principal by 100*l*. and she does not intend to marry any man who is not scholar enough to tell her fortune; pray what is it? *Ans.* 10000*l*.

DOUBLE POSITION.

DOUBLE Position teaches to solve such questions as require two supposed numbers in the operation.

RULE.

Suppose 2 numbers, and work with each agreeably to the tenor of the question, noting the errors of the results: multiply the errors of each operation into the supposed number of the other; then,

If the errors be alike, i. e. both too much, or too little, take their difference for a divisor, and the difference of the product for a dividend: but if unlike, take their sum for a divisor, and the sum of the products for a dividend.

Note. In many instances, if 0 be used for the first, and 1 for the second of the supposed numbers, the first of the errors, divided by their difference, will be the answer.

PROOF.

As in Single Position.

EXAMPLES.

1. A farmer hired a labourer on this condition, that for every day he worked, he should receive 12*d.* but for every day he was idle, he should be fined 8*d.*; when 390 days were past, neither of them was indebted to the other; how many days did he work?

Suppose 1st. 140 working days. 2*d.* 150
 390—140=250 idle. 240

140 × 12 = 1680 earned. 150 × 12 = 1800
 250 × 8 = 2000 fined. 240 × 8 = 1920

Error too little 320 too little 120
150

320 48000 16800
 120 16800

2 | 00) 312 | 00

Ans. 156 days.

Or thus:

Suppose 1st. 0 working day. 3*d.* 1
 • then 390 idle. 389

0 × 12 = 0 earned. 1 × 12 = 12
 390 × 8 = 3120 fined. 389 × 8 = 3112

Error too little 3120 too little 3100
3100

2 | 0) 312 | 0

Ans. 156 days.

2. Divide 100*l.* so that B may have twice as much as A, wanting 8*l.* and C three times as much, wanting 15*l.*; what is each man's share? *Ans.* A 20*l.* 10*s.* B 33*l.* C 46*l.* 10*s.*

3. Of 240 dol. expenditure, B paid 24 dol. more than A, and C as much as A and B; each man's part is required?

Ans. A 48 dol. B 72 dol. C 120 dol.

4. A is 20 years of age; B's age is A's and half C's, and C's equals them both; their several ages are required?

Ans. A 20, B 60, C 80 years.

5. The head of a fish is 9 inches long, and its tail is as long as its head and half the body, and the length of the body equals that of the head and tail; what is its whole length?

Ans. 6 feet.

6. A labourer hired for 40 days, upon this condition, that he should receive 20 cts. for every day he wrought, and forfeit 10 cts. for every day he was idle, at settlement he received 5 dols. How many days did he work, and how many was he idle?

Ans. wrought 30 days, idle 10.

7. Bought 15 yards for 8 dol. 40 cts. viz. damask at 96 cts. per yard, and lining for it, at 36 cts. per yard; what quantity was there of each?

Ans. 5 yds. damask, 10 yds. lining.

8. A and B put equal sums of money in trade; A gained a sum equal to $\frac{1}{4}$ of his stock, and B lost 540 dols. then A's money was double that of B's, what capital did each of them begin with?

Ans. 1440 dol.

9. When first the marriage knot was ty'd

Between my wife and me;

My age was to that of my bride,

As three times three to three;

But now when ten and half ten years,

We man and wife have been,

Her age to mine exactly bears

As eight is to sixteen.

Now tell, I pray, from what I've said,

What were our ages when we wed?

Ans. { Thy age, when married, must have been
Just forty-five; thy wife's fifteen.

PERMUTATION.

PERMUTATION is a rule for finding how many different ways, any given number of things may be varied in position or succession; thus, abc, acb, bac, bca, cab, cba, are six different positions of three letters.

RULE.

Multiply all the terms of the natural series continually, from one to the given number inclusive, the last product will be the changes required.

EXAMPLES.

1. In how many different positions can five persons place themselves at table? $1 \times 2 \times 3 \times 4 \times 5$ 120 *Ans.*

2. What number of changes may be rung upon 12 bells, and in what time may they be rung, allowing 3 seconds to every round?

Ans. { 479001600 changes.
45 years, 195 days, 18 hrs.

3. What time will it require for 8 persons to seat themselves every day differently at dinner? *Ans.* 110 years, 142 days.

4. What number of variations will the 26 letters of the alphabet admit of? *Ans.* 403291461126605635584000000.

COMBINATION.

COMBINATION discovers how many different ways a less number of things may be combined out of a greater; thus, out of the letters a, b, c, are three different combinations of two, viz. ab, ac, bc.

RULE.

Take a series proceeding from, and increasing by an unit, up to the number to be combined; and another series of as many places, decreasing by unity, from the number out of which the combinations are to be made, multiply the first continually for a divisor, and the latter for a dividend, the quotient will be the answer.

EXAMPLES.

1. How many combinations of 5 letters in 10?

$$\begin{array}{r} \bar{2} \quad \quad \bar{2} \quad \quad \bar{2} \\ 10 \times 9 \times 8 \times 7 \times 6 \\ \hline = 252 \text{ Ans.} \end{array}$$

$$1 \times 2 \times 3 \times 4 \times 5$$

2. What is the value of as many different dozens as may be chosen out of 24, at one cent per dozen? *Ans.* 27043.56 dol.

3. How many different ways may a butcher select 50 sheep out of a flock consisting of 100, so as not to make the same choice twice? *Ans.* 10891306544874079257172497256.

DUODECIMALS.

DUODECIMALS are fractions of a foot, or of an inch or parts of an inch, having 12 for their denominator.

The denominations are,

12 fourths, <i>III</i> ,	make 1 third, <i>II</i> .
12 thirds	1 second, <i>U</i> .
12 seconds	1 inch, <i>I</i> .
12 inches	1 foot, <i>Ft</i>

ADDITION OF DUODECIMALS.

RULE.

Add as in Compound Addition, carrying 1 for each 12 to the next denomination.

EXAMPLES.

<i>Ft.</i>	<i>I.</i>	<i>U.</i>	<i>III.</i>	<i>IIII.</i>	<i>Ft.</i>	<i>I.</i>	<i>U.</i>	<i>III.</i>	<i>IIII.</i>
14	4	3	5	6	28	4	3	7	10
85	7	8	6	6	71	7	8	4	2
56	10	5	7	9	67	11	3	7	5
43	1	6	4	3	32	0	8	4	7
87	11	10	8	5	46	3	8	11	10
48	5	2	10	11	67	11	9	4	11

336 5 1 7 4

1. Five floors in a certain building contain each 1295*f.* 9*i.* 8*II*, how many feet in all? *Ans.* 6479*f.* 0*i.* 4*II*.

2. Several boards measure as follow: viz. 27*f.* 3*i.* 25*f.* 11*i.* 20*f.* 10*i.* 20*f.* 9*i.* 20*f.* 6*i.* 18*f.* 5*i.* what number of feet do they contain? *Ans.* 133*f.* 8*i.*

SUBTRACTION OF DUODECIMALS.

RULE.

Work as in Compound Subtraction, borrowing 12 when necessary.

EXAMPLES.

<i>Ft.</i>	<i>I.</i>	<i>U.</i>	<i>III.</i>	<i>IIII.</i>	<i>Ft.</i>	<i>I.</i>	<i>U.</i>	<i>III.</i>	<i>IIII.</i>
From 176	1	2	6	10	3786	10	1	6	7
Take 97	10	1	7	11	987	8	11	6	9

Rem. 78 3 0 10 11

2. From a board measuring 41*f.* 7*i.* cut 19*f.* 10*i.* and what is left? *Ans.* 21*f.* 9*i.*

MULTIPLICATION OF DUODECIMALS.

CASE 1.

When the feet of the multiplier do not exceed 12;

RULE.

Set the multiplier in such order that the feet thereof may stand under the lowest denomination of the multiplicand, and in multiplying carry one for every 12 from one denomination to another, and place the result of the lowest denomination in the multiplicand, under its multiplier.

Note 1. If there be no feet in the multiplier, supply their place with a cypher.

2. Whether we begin with the highest or lowest denomination of the multiplier, the several denominations of the products will be respectively synonymous with those of the multiplicand under which they are placed.

EXAMPLES.

	<i>Ft.</i>	<i>I.</i>	<i>II.</i>	<i>Ft.</i>	<i>I.</i>	<i>II.</i>
Multiply	7	9		8	6	9
by 3 <i>f.</i> 6 <i>in.</i>		3	6		7	3
					8	
	3	10	6		5	8
	23	3			2	1
					8	3
				59	11	3
Product	27	1	6	62	6	7
					9	0

2. A floor is 79*f.* 8*i.* by 18*f.* 11*in.* how many square feet are therein?

Ans. 710*f.* 4*in.* 4*ll.*

3. A mahogany board measures 28*f.* 10*in.* 6*ll.* by 3*f.* 2*in.* 4*ll.* what is its contents?

Ans. 92*f.* 2*in.* 10*ll.* 6*lll.*

CASE 2.

When the feet of the multiplier exceed 12;

RULE.

Use the component parts of the feet in the multiplier as in Compound Multiplication, and take parts for the inches, &c.

EXAMPLES.

<i>Feet.</i>	<i>I.</i>	<i>II.</i>	<i>Feet.</i>	<i>I.</i>	<i>II.</i>
Multiply 311	4	7	by 36	7	5
			6	6	36

1868 8 6
6

I. 11209 9 0
6 = $\frac{1}{2}$ 155 8 3 0
1 = $\frac{1}{4}$ 25 9 8 7
4 = $\frac{1}{2}$ 8 7 2 10 4
1 = $\frac{1}{4}$ 2 1 9 8 7

Product 114002 0 0 7 11

2. A partition is 82f. 6in. by 13f. 3in. how many square feet does it contain? *Ans.* 1093f. 1i. 6ll.

3. If a ceiling be 59f. 9i. long, and 24f. 6i. broad; how many yards does it contain? *Ans.* 162 yds. 5f. +

4. There is a yard of 21.5 feet, by 17.5 feet, which is to be paved with stones of 18 inches square; how many stones are necessary for the purpose? *Ans.* 167 +

PROMISCUOUS QUESTIONS.

1. A was born when B was 21 years of age; how old will A be when B is 47; and what will be the age of B when A is sixty? *Ans.* A 26, B 81.

2. Two persons depart from the same place at the same time; the one travels 30, the other 35 miles a day; how far are they distant after 7 days, if they travel both the same road, and how far if they travel in contrary directions? *Ans.* 35 and 455 miles.

3. To how much amounts the order, for which a factor, at the rate of $2\frac{1}{2}$ per cent. per annum, receives 54 dollars? *Ans.* 2160 dol.

4. A, B, C, and D, are sharers in the value of a parcel of merchandise; A, B and C, have 350l. B, C and D, 345l. C, D and A, 400l. and D, A and B, 378l. query the whole sum, and each man's particular part? *Ans.* sum 491l. A 146l. B. 91l. C 113l. D 141l.

5. A stationer sold quills at 1 dol. 26 cts. a thousand, by which he cleared $\frac{1}{3}$ of the money, but growing scarce, raised them to 1 dol. 44 cts. a thousand; what did he clear per cent. by the latter price? *Ans.* 71.42 $\frac{2}{3}$ dol.

6. A person possessed of $\frac{3}{4}$ of a ship, sold $\frac{2}{3}$ of his share for 3024 dol. what was the value of the whole at the same rate? *Ans.* 12096 dol.

7. Bought a quantity of goods for 600 dol. and 3 months after sold it for 660 dols. How much per cent. per annum was gained by them? *Ans.* 40 per cent. gained.

8. A guardian paid his ward 8400 dol. for 6000 dol. which he had in his hands 8 years; what rate of interest did he allow him? *Ans.* 5 per cent.

9. Bought a quantity of goods for 360 dol. ready money, and sold it again for 480 dol. payable at the end of 9 months; what was the gain in ready money, supposing rebate to be made at 5 per cent.? *Ans.* 102.65 dol. +

10. A person being asked the hour of the day, said, the time past noon is equal to $\frac{1}{4}$ ths of the time till midnight, what was the time? *Ans.* 20 min. past 5.

11. A person looking on his watch, was asked what was the time of day, who answered, it is between 4 and 5 ; but a more particular answer being required, he said that the hour and minute hands were then exactly together ; what was the time ?

Ans. $21\frac{1}{7}$ min. past 4.

12. With 12 gallons of canary, at 76 cts. a gallon, I mixed 18 gallons of white wine at 58 cts. a gallon, and 12 gallons of cider, at 37 cts. a gallon, at what rate must I sell a quart of this composition so as to clear 10 per cent. ?

Ans. 15 cts. 7 m.

13. What sum of money will produce as much interest in $3\frac{1}{2}$ years, as 504.36 dol. would in 5 years and 5 months ?

Ans. 840.6 dol.

14. If 240 dol. in 5 years be allowed to gain 49.2 dol. in what time will any sum of money double itself at the same rate of interest ?

Ans. $24\frac{1}{2}$ years.

15. What difference is there between the interest of 840 dol. at 4 per cent. for 8 years, and the discount of the same sum at the same rate, and for the same time ?

Ans. 65.16 dol.

16. If by selling goods at 6 dol. per Cwt. I gain 20 per cent. what do I gain or lose per cent. by selling at 5.46 dol. per Cwt. ?

Ans. 9 dol. 20 cts. gain.

17. Sold goods for 151.7 dol. and by so doing lost 17 per cent. whereas I ought in dealing to have cleared 20 per cent. then how much under their just value were they sold ?

Ans. 67.425 dol.

18. What is the sum of the third and half third of four pence ?

Ans. 2d.

19. What difference is there between 6 dozen dozen, and half a dozen dozen ?

Ans. 792.

20. A merchant who hired a clerk for 120 dol. per annum payable quarterly, has (agreeably to a subsequent contract) retained the young man's salary in trade for 11 years and an half, on conditions of allowing him 6 per cent. compound interest, on the several payments, as they became due ; how much has he now in the merchant's hands ?

Ans. 1951.32 + dol.

21. In what time will 48 dol. a year raise a stock of 402.904 dol. compound interest being computed at 6 per cent. per annum ?

Ans. 7 years.

22. Which would be preferable, an annual rent of 876 dol. clear for 12 years, to be received in quarterly payments, or 7200 dol. in hand, reckoning interest at 5 per cent. ?

Ans. the annuity, by 1272 + dol.

23. When $\frac{1}{2}$ the members of an assembly + 15 were met, there were $\frac{1}{3}$ + 10 absent ; how many did that branch of the legislature consist of ?

Ans. 150.

Ans. The term is better than the reversion by 911.13 dol.

Ans. 343.095 + dol. per annum.

Ans. B's by upwards of 265.56 dol.

Ans. 11.

Ans. 99%.

Ans. in 16 years, 8 mo.

Ans. in 11.8937 years.

Ans. 83.1889 dol.

Ans. 2891505*l.* per annum.

millions of pounds.

Ans. 39.

Q2

miles a day ; admitting there were no obstacles, and reckoning 365 $\frac{1}{4}$ days in the year ? *Ans.* 3 years, 155 $\frac{1}{4}$ days.

36. Bought goods to the amount of 179.76 dols. and allowed discount at 5 per cent. what come they to ? *Ans.* 171.2 dol.

37. What is the mean time for paying 240 dols. at 3 $\frac{1}{2}$ months, 360 dol. at 4 $\frac{1}{2}$ months, and 489.6 dols. at 5 $\frac{1}{2}$ months ?

Ans. 4 months, 23 days 4 $\frac{1}{4}$.

38. What must be paid for $\frac{3}{8}$ of a ship that is valued at 3360 dols. ? *Ans.* 630 dols.

39. Take the aliquot parts $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$, $\frac{1}{16}$, successively one from the other, out of 6s. and 9 $\frac{1}{2}$ d. and give their sum ?

Ans. 2s. 11 $\frac{1}{2}$ d. 7 $\frac{1}{16}$.

40. How many yards of stuff, that is 7yd. wide, will line 7 $\frac{1}{2}$ ells English, that is an ell Flemish wide ? *Ans.* 7yds. 3qr. 2na. 4?

41. E can mow an acre of grass in 7 $\frac{1}{2}$ of an hour, and F in 8 $\frac{1}{2}$ of an hour ; in what time would they mow an acre, both of them working together ? *Ans.* 4 hours.

42. In an orchard of fruit trees, $\frac{1}{2}$ of them bear apples, $\frac{1}{4}$ pears, $\frac{1}{8}$ plums, 60 of them peaches, and 40 cherries, how many trees does the orchard contain ? *Ans.* 1200.

43. A person who was possessed of $\frac{3}{5}$ of a vessel, sold $\frac{1}{6}$ of his interest for 780 dol. what was the ship worth at that rate ? *Ans.* 3120 dol.

44. If $\frac{1}{4}$ of $\frac{3}{5}$ of $\frac{1}{2}$ of a ship be worth $\frac{1}{6}$ of $\frac{1}{2}$ of $\frac{1}{3}$ of the cargo, valued at 2400 dols. what did both ship and cargo cost ?

Ans. 4410.25 dol. +

45. A younger brother received 3744 dols. which was just $\frac{1}{12}$ of his elder brother's fortune, and 5 $\frac{1}{2}$ times the elder's money was $\frac{2}{3}$ of what the father was worth ; what was his estate valued at ? *Ans.* 51747.42 dols.

46. A gentleman left his son a fortune ; $\frac{1}{5}$ of which he spent in 3 months ; $\frac{3}{4}$ of $\frac{1}{5}$ of the remainder lasted him 9 months longer, when he had only 1288.8 dols. left ; what did his father bequeath him ? *Ans.* 4998 98 dol.

47. If A can do a piece of work alone in 7 days, and B in 12 ; set them both about it together ; in what time will they finish it ?

D. W. D. W.

W. W. W.

$$\text{As } \left\{ \begin{array}{l} 7 : 1 :: 1 : \frac{1}{7} \\ 12 : 1 :: 1 : \frac{1}{12} \end{array} \right\}$$

$$\text{Then, } \frac{1}{7} + \frac{1}{12} = \frac{19}{84}$$

W. D. W. D.

$$\text{As } \frac{19}{84} : 1 :: 1 : 4\frac{4}{19} \text{ } \text{Ans.}$$

48. A and B together can build a boat in 20 days ; with the assistance of C they can do it in 12 days ; in what time could C do it by himself ? *Ans.* 30 days.

$$\text{As } \left\{ \begin{array}{l} \text{D. W. D. W.} \\ 20 : 1 :: 1 : \frac{1}{20} \\ 12 : 1 :: 1 : \frac{1}{12} \end{array} \right\}$$

$$\text{W. W. W.} \\ \text{Then, } \frac{1}{\frac{1}{20} + \frac{1}{12}} = \frac{24}{7} \text{ and} \\ \text{W. D. W. D.}$$

As 8 : 1 :: 240 : 30 Ans.

52. A can do a piece of work alone in 18 days, and A and B together in 8 days; in what time can B do it alone?

$$\text{As } \left\{ \begin{array}{l} \text{D. W. D. W.} \\ 18 : 1 :: 1 : \frac{1}{18} \\ 8 : 1 :: 1 : \frac{1}{8} \end{array} \right\}$$

$$\text{W. W. W.} \\ \text{Then, } \frac{1}{\frac{1}{18} + \frac{1}{8}} = \frac{72}{5} \text{ and} \\ \text{W. D. W. D.}$$

As 5 : 1 :: 104 : 204 Ans.

53. A B and C, can complete a piece of work in 15 days; A can do it alone in 30 days, and B in forty days, in what time can C do it by himself?

$$\text{As } \left\{ \begin{array}{l} \text{D. W. D. W.} \\ 15 : 1 :: 1 : \frac{1}{15} \\ 30 : 1 :: 1 : \frac{1}{30} \\ 40 : 1 :: 1 : \frac{1}{40} \end{array} \right\}$$

$$\text{W. W. W. W.} \\ \text{Then, } \frac{1}{\frac{1}{15} + \frac{1}{30} + \frac{1}{40}} = \frac{60}{7} \text{ and} \\ \text{W. D. W. D.}$$

As 1 : 1 :: 120 : 120 Ans.

54. A cistern for water has two cocks to supply it, by the first it may be filled in 45 minutes, and by the second, in 55 minutes; it has likewise a discharging cock, by which it may when full be emptied in 30 minutes; now if these three cocks be all left open when the water comes in, in what time may it be filled?

M. Cist. M. Cist.

Cist. Hr. Cist. h. m. s.

45 : 1 :: 60 : 1.3333 As .4242 : 1 :: 1 : 2 21 26½ Ans.

55 : 1 :: 60 : 1.0909

2.4242

30 : 1 :: 60 : 2

Gains in an hr. 4242 of a cistern.

55. The hour and minute hand of a watch are exactly together at 12 o'clock; when are they next together?

The velocities of the two hands of a watch or clock, are to each other, as 12 to 1; therefore the difference of velocities is 12-1=11.

h. m. s.

$$\text{As } 11 : 1 :: \left\{ \begin{array}{l} 12 \times 1 :: 1 \quad 5 \quad 27 \frac{3}{11} \\ 12 \times 2 :: 2 \quad 10 \quad 54 \frac{6}{11} \\ 12 \times 3 :: 3 \quad 16 \quad 21 \frac{9}{11} \end{array} \right\} \text{Ans. \&c.}$$

56. A fellow said when he counted his nuts, two by two, three by three, four by four, five by five, and six by six, there was still an odd one; but when he told them seven by seven, they came out even; how many had he?

$$2 \times 3 \times 4 \times 5 \times 6 = 720, \text{ and } 720 \div 7 = 103 \text{ even, } \text{Ans. } 721$$

—respectively, will leave an odd one.

2.3.4.5 and 6.

57. There is an island, 50 miles in circumference, and 3 men start together to travel the same way about it. A goes 7 miles per day, B 8, and C 9; when will they all come together again, and how far will each travel?

$$50 \times 7 \div 7 + 50 \times 8 \div 8 + 50 \times 9 \div 9 = 50 \text{ days—A } 350 \text{ miles, B } 400, \text{ and C } 450 \text{ Ans.}$$

58. Three persons purchase a vessel in company, towards the payment whereof A advanced $\frac{2}{3}$, B $\frac{1}{3}$, and C 614.4 dol. what did A and B pay each, and what part of the vessel had C?

$$\text{Ans. A } 1438.6 \text{ dol. B } 1536 \text{ dol. C's part } \frac{2}{3}.$$

59. A line 35 feet long, will exactly reach from the top of a fort standing on the brink of a river, to the opposite bank, known to be 27 feet broad; what is the height of the wall?

$$\text{Ans. } 22 \text{ feet, } 3\frac{1}{2} \text{ inches nearly.}$$

60. A bullet is dropped from the top of a building, and found to reach the ground in $1\frac{3}{4}$ seconds; required its height.

$$1.75 \times 4 = 7 \text{ and } 7 \times 7 = 49 \text{ feet, } \text{Ans.}$$

61. What is the difference between the depth of two wells, into each of which should a stone be dropped in the same instant, one would reach the bottom in 5 seconds, and the other in three?

$$5 \times 4 = 20, \text{ and } 20 \times 20 = 400 \text{ feet.}$$

$$3 \times 4 = 12, \text{ and } 12 \times 12 = 144 \text{ feet.}$$

$$\text{Ans. } 256 \text{ feet.}$$

62. Ascending bodies are retarded in the same ratio that descending bodies are accelerated; therefore if a ball discharged from a gun, return to the earth in 12 seconds; how high did it ascend?

$$\text{Ans. } 576 \text{ feet.}$$

63. In what time will a musket ball, dropped from the top of a steeple 484 feet high, come to the ground?

$$\text{Ans. } 5\frac{1}{2} \text{ sec.}$$

FINIS.

COURSE OF BOOK KEEPING,

BY

SINGLE ENTRY.

It would be superfluous to state, that every person of business ought to be acquainted with Book Keeping; the consequences of ignorance in so necessary a part of education too many have experienced, in the course of their commercial transactions. It is hoped the following treatise will be found to contain all the essential examples pertaining to Book Keeping by Single Entry. The calculations are easy, various, and such as generally occur in business. After preparing your Day Book with proper lines, you will notice that you must insert every person's name therein, as follows, viz. *Dr.* to the articles he or she receives on credit, and *Cr.* for the articles or money which you may obtain from any person. For all persons with whom the Day Book records any dealings, the Ledger is thus made use of. The goods or money, for which you are indebted, are entered on the right hand or *Cr.* side, and those for which others stand indebted to you are placed on the left or *Dr.* side. At stated and proper periods, say at the end of each month's account, transfer your accounts from the Day Book to the Ledger, which is called *Posting*. Thus: divide the page into three equal parts, beginning with the names of persons as they occur, writing them as you see by reviewing any page of the Ledger, and then entering them in the alphabet with each surname under its proper letter, with the page in which it stands in the Ledger; remembering to insert in the small column to the left of that for dollars and cents marked *d. p.* or Day Book page, the page said account stands on in the Day Book; likewise noting in the margin of the latter, the page it is posted on in the Ledger, writing also the date of

Day Book.

January 19th, 1818.			D.	C.
<i>Reuben Hilyard,</i> Dr.				
To 18 wine glasses, at 3 25 per doz.	-	-	4	87½
26th.				
<i>Peter Calhoun,</i> Cr.				
By cash in full,	-	-	45	00
29th.				
<i>Duncan Jones,</i> Dr.				
To 4 gals. anniseed cordial, at 1 37½	-	5 50		
3 lemon do. 1 50	-	4 50		
			10	00
31st.				
<i>Daniel Whitney,</i> Dr.				
To 12 yds. muslin, at ,38	-	4 56		
3½ doz. buttons, gilt, at ,87½	-	3 06½		
			7	62½
<i>Samuel Farrand,</i> Dr.				
To 2 fine hats, at 6 00	-	12 00		
2 pair shoes, at 2 37½	-	4 75		
3 stockings, at 1 12½	-	3 37½		
			20	12½
February 1st.				
<i>Daniel Steinmetz,</i> Cr.				
By 50 lb. butter, at ,20	-	10 00		
3 cheese, weighing 45 lb. at ,17		7 65		
			17	65
11th.				
<i>Hezekiah Tropic,</i> Cr.				
By 6 boxes oranges, at 5 00	-	-	30	00
14th.				
<i>Samuel Stevens,</i> Dr.				
To 11½ yds. calico, at ,62½	-	7 34½		
¾ velvet, at 11 00	-	8 25		
6½ bombazet, at ,75	-	4 87½		
4 skeins silk, at ,9½	-	37		
			20	84
19th.				
<i>Duncan Jones,</i> Dr.				
To 1 box figs, wt. 30 lb. at ,18½	-	5 55		
1 prunes, wt. 25 lb. at ,22½	-	5 62½		
			11	17½

Day Book.

February 23d, 1818.			D.
2	<i>William Andrews,</i>	Cr.	
	By cash in full,	- - - -	34
March 5th.			
5	<i>Samuel Joseph,</i>	Dr.	
	To 16 gal. Madeira wine, at 3 00	- - 48 00	
	4 Holland gin, 2 00	- - 8 00	
			56
16th.			
6	<i>Willoughby Kingston,</i>	Dr.	
	To ½ doz. silver spoons,	- - 7 00	
	1 can, wt. 30oz. 5½wt. at 2 00	- - 60 50	
	1 bowl, 16oz. 1 39	- - 21 92	
			89
23d.			
6	<i>John Wetherill,</i>	Dr.	
	To 6 Cwt. 3 qrs. 20lb. lead, at \$7½ per lb.	- - 297	
30th.			
6	<i>Martin Quinn,</i>	Dr.	
	To ½ doz. chairs, at 13 75	- - 6 87½	
	1 pair card tables,	- - 25 00	
	1 looking glass,	- - 22 00	
	1 toilet table,	- - 3 00	
			56
April 5th.			
3	<i>Reuben Hilyard,</i>	Dr.	
	To 6 gal. spermaceti oil, at 1 10	- - 6 60	
	13 lb. soap, at 15	- - 1 95	
	17½ rice, at 8	- - 1 40	
	1 qt. molasses, West-India,	- - 0 20	
			10
16th.			
4	<i>Daniel Whitney,</i>	Dr.	
	To 6½ yds. drab cloth, at 7 25	- - 45 31	
	7 flannel, 0 75	- - 5 25	
	3 pair blankets, 6 00	- - 18 00	
	2 yds. waistcoating, 1 50	- - 3 00	
			71
27th.			
7	<i>Nicholas Burkitt,</i>	Dr.	
	To 3 pair women's gloves,	- - 2 75	
	1 do. stockings,	- - 1 25	
			4

Day Book.

May 3d, 1818.			D.	C.
1	<i>Peter Calkoun,</i>	Dr.		
	To 20 pieces hanging paper, at .50	- 10 00		
	8 superior do. at 1 00	- 8 00		
			18	00
7th.				
7	<i>William Bird,</i>	Dr.		
	To 1 pair andirons,	- 7 00		
	shovel and tongs,	- 3 75		
	3 snuffers, at .75	- 2 25		
	1 fender,	- 9 00		
			22	00
12th.				
7	<i>John Teacher,</i>	Dr.		
	To 3 doz. copy books, at 1 25	- 3 75		
	4 Murray's Grammars, at 7 50	30 00		
	6 Byerly's Spelling Books, at 1 75	10 50		
	1 ream letter paper,	- 4 50		
			48	75
18th.				
7	<i>Nicholas Burkitt,</i>	Dr.		
	To 1 piece book muslin, 20 yds. at 2 00	40 00		
	1 dimity, 20	72 14 40		
	7½ yds. mull mull muslin,	3 00 22 50		
			76	90
29th.				
8	<i>Reuben Hilyard,</i>	Cr.		
	By cash in full,	- - -	15	2½
June 3d.				
8	<i>Jane Russel,</i>	Dr.		
	To 1 box of candles, 30lb. at .20	- 6 00		
	4 bottles mustard, .37½	- 1 50		
	3 flasks sweet oil, .75	- 2 25		
	1 box almonds, 24lb., .20	- 4 80		
			14	55
4th.				
8	<i>Richard Prichett,</i>	Dr.		
	To 3 pair cotton hose, at 1 25	- 3 75		
	2 silk do. 2 50	- 5 00		
	2 gloves, 1 00	- 2 00		
			10	75
	Per Mrs. Prichett.			

		June 6th, 1818.		D.	C.
Paid.	3	<i>Shadrach Mercer,</i>	Dr.		
		To 17 bushels of wheat, at 2-50	- 42 50		
		10 corn, 1 10	- 11 00		
		3 buck-wheat, at 1 50	4 50		
				58 00	
		10th.			
		<i>Jemima Daisy,</i>	Dr.		
		To 1 piece long lawn, 20 yds. at 1 12½	22 50		
		6 yards linen cambric, 4 50	27 00		
		6 levantine, 2 00	12 00		
	4	1 piece Canton crape	17 00		
		1 cambric muslin, 12 yds. at 1 00	12 00		
				90 50	
		12th.			
		<i>Daniel Whitney,</i>	Dr.		
		To 3 bbls. superfine flour, at 11 25	33 75		
		3cwt. 1qr. 17lb. rye, ,04	15 24		
		12 bushels peas, ,34	4 08		
				53 07	
		22d.			
	3	<i>Shadrach Mercer,</i>	Cr.		
		By cash in full,	-	71 56	
		22d.			
	9	<i>Abijah Wholesale,</i>	Cr.		
		By 3 hhd. Lisbon wine, at 2 00 per gal.	-	378 00	
		30th.			
	9	<i>Abijah Wholesale,</i>	Dr.		
		To my note at 90 days, for	-	378 00	
		30th.			
	5	<i>Samuel Stevens,</i>	Dr.		
		To 2 pieces Nankeen, 11 yds. at ,31	- 3 41		
		1 thousand needles, -	- 4 50		
		16 yds. lace, at ,75	- 12 00		
				19 91	
		July 8th.			
	4	<i>Daniel Whitney,</i>	Cr.		
		By 7 M. quills, at 6 00	- 42 00		
		Cash in full, -	- 37 18		
				79 18	
		10th.			
	8	<i>Richard Prichett,</i>	Dr.		
		To 1 tea set China, -	- 75 00		
		1 dinner do. -	- 40 00		
				115 00	

July 17th, 1818.			D.	C.
6	<i>John Wetherill,</i> Cr.			
	By his note at 60 days, for	- - -	175	
	21st.			
4	<i>Daniel Steinmetz,</i> Dr.			
	To 1 lot of seine twine, - - -	13 87½		
	40 lb. of bacon, at 11 - - -	4 40		
	6 candles, 19 - - -	1 14		
	25th.		19	41½
5	<i>Samuel Joseph,</i> Dr.			
	To 20 yds. furniture chintz; at 72 - -	14 40		
	Mattress, - - -	8 00		
	27th.		22	40
7	<i>William Bird,</i> Dr.			
	To 2 doz. knives and forks, at 2.50 - -	5 00		
	3 pair sad irons, at 1.25 - - -	3 75		
	½ doz. waiters, - - -	2 00		
	1 castor, - - -	3 00		
	31st.		13	75
2	<i>Young & Davis,</i> Cr.			
	By 1 box sugar, 2 Cwt. 3qr. 13lb. at 16 -	51 36		
	By cash in full, - - -	4 14		
	August 1st.		55	50
1	<i>James M^c Corkle,</i> Cr.			
	By cash received of his brother, - -		40	00
	6th.			
4	<i>Samuel Farrand,</i> Cr.			
	By 4 pieces Russia sheeting, 120 yds. at 55 -		66	00
	8th.			
7	<i>John Teacher,</i> Dr.			
	To 6 doz. Williams' writing pieces, at 5 00 -		30	00
7	<i>John Teacher,</i> Cr.			
	By his bill for one year's tuition, - -		37	60
	12th.			
1	<i>James M^c Corkle,</i> Dr.			
	To 1 map of the United States, - -	10 00		
	1 Carey's Atlas, - - -	14 00		
			24	00

August 18th, 1818.				D.	C.
9	<i>Nathaniel Chemist,</i>	<i>Dr.</i>			
	To 1 qt. alcohol, - - -		,25		
	1 lb. sulphuric acid, - - -		1 00		
	1 manganese, - - -		,37½		
	2 glass retorts, at 37½ - - -		,75		
				2	37½
	23d.				
4	<i>Daniel Steinmetz,</i>	<i>Dr.</i>			
	To 1 bbl. Boston mackerel, - - -			12	00
	29th.				
6	<i>Martin Quinn,</i>	<i>Cr.</i>			
	By 1 mahogany bedstead, - - -			38	00
	September 1st.				
5	<i>Samuel Stevens,</i>	<i>Cr.</i>			
	By 1 piece Irish linen, 25 yds. at 1 12½		28 12½		
	Do. Bandanna hdkfs. - - -		10 50		
				38	62½
	5th.				
9	<i>Abijah Wholesale,</i>	<i>Cr.</i>			
	By 3 bbls. cider, at 5 00 - - -		15 00		
	2 vinegar, at 4 00 - - -		8 00		
				23	00
	7th.				
5	<i>Samuel Joseph,</i>	<i>Cr.</i>			
	By cash in part, - - -			19	91
	10th.				
5	<i>Hezekiah Tropic,</i>	<i>Dr.</i>			
	To cash paid him in full, - - -			30	00
	15th.				
7	<i>Nicholas Burkitt,</i>	<i>Cr.</i>			
	By cash in part, - - -			50	00
4	<i>Daniel Whitney,</i>	<i>Dr.</i>			
	To 1 piece of shirting muslin, 35 yds. at ,75			26	25
	23d.				
8	<i>Daniel Whitney,</i>	<i>Dr.</i>			
	To 4 groce button moulds, at ,15½		,62		
	10 doz. twist, ,79 - - -		7 90		
				8	52

Day Book.

September 23d, 1818.				D.	C.
<i>Nathaniel Chemist,</i>			<i>Dr.</i>		
To 1 oz. phosphorus,	-	-	3 00		
8 nitrate of silver, at ,31½	-	-	2 50		
12 lb. nitric acid, at ,87½	-	-	10 50	16	00
29th.					
<i>Jane Russel,</i>			<i>Dr.</i>		
To 12 flats Leghorn, at 20 00	-	-	240 00		
6 do. chip, 6 00	-	-	36 00		
1 box ribands, sundry colours,	-	-	65 00		
				341	00
October 7th.					
<i>Jane Russel,</i>			<i>Cr.</i>		
By cash received in part,	-	-	-	50	00
12th.					
<i>John Teacher,</i>			<i>Cr.</i>		
By his note at 60 days, for	-	-	-	50	00
15th.					
<i>Duncan Jones,</i>			<i>Cr.</i>		
By cash in full,	-	-	-	21	17½
30th.					
<i>Uriah Nathans,</i>			<i>Dr.</i>		
To 3 gals. lemon cordial, at 1 00	-	-	3 00		
6 bottles perfect love, 1 00	-	-	6 00		
3 cinnamon cordial, 1 00	-	-	3 00		
2½ gals. rose water, 1 50	-	-	3 75		
				15	75
November 7th.					
<i>Skadrach Mercer,</i>			<i>Cr.</i>		
By 120 bushels malt, at ,46	-	-	-	55	20
10th.					
<i>Richard Old,</i>			<i>Dr.</i>		
To 28 lb. sugar, at ,12½	-	-	3 50		
1 loaf, 13lb. do. ,30	-	-	3 90		
12 lb. currants, ,14	-	-	1 68		
2 green tea, 1 50	-	-	3 00	12	08

November 15th, 1818.				D.	C.
2	<i>Barton Smith,</i>	Dr.			
	To 5 firkins butter, wt. as follows :				
	No. 1, 59 lb. tare 8 lb.				
	2, 46	10			
	3, 37	12			
	4, 61	11			
	5, 80	16			
	gross 303	57			
	tare 57				
	neat 246 at ,22½	- - -		55	96½
	22d.				
2	<i>Barton Smith,</i>	Dr.			
	To sundry sea stores for brig James, viz.				
	26 lb. coffee, at ,30	- -	7 80		
	36 sugar, ,12½	- -	4 50		
	10½ loaf do. ,27	- -	2 83½		
	4 imperial tea, 2. 25	- -	9 00		
	5 mustard, ,15	- -	0 75		
	1 peck salt, -	- -	2 50		
	1 lb. ginger, -	- -	0 35		
	3 gals. Madeira, 3 25	- -	9 75		
	2 gin, 1 71½	- -	3 42½		
	2 bottles sweet oil, ,62½	- -	1 25		
	2 gals. molasses, ,27	- -	0 54		
				42	70
10	December 1st.				
	<i>Judith Eastborn,</i>	Dr.			
	To 10 yds. taffeta, at 1 75	- -	17 50		
	3 check, ,36	- -	1 08		
	7, black lace, ,75	- -	5 25		
	4 lb. thread, ,50	- -	2 00		
				25	83
8	8th.				
	<i>Daniel Whitney,</i>	Dr.			
	To sugar, 3 bbls. wt. as follows :				
	No. 1, 1C. 3qr. 18lb.				
	2, 1 3 14				
	3, 1 1 19				
	gross 5 0 23				
	tare 2 15				
	neat 4 2 8 at ,21 per lb.			107	52

December 17th, 1818.				D.	C.
2	<i>Barton Smith,</i>	<i>Dr.</i>			
	To 4 reams foolscap paper, at 4 50	- -		18	00
10	<i>Barton Smith,</i>	<i>Dr.</i>			
	To loaf sugar, 13lb. at ,30	- - - 3 90			
	2 doz. China cups and saucers, 2 75	5 50			
	Cash lent, - - - - -	16 75		26	15
	20th.				
10	<i>Judith Eastborn,</i>	<i>Cr.</i>			
	By cash in full, - - - - -			25	83
	25th.				
9	<i>Uriah Nathans,</i>	<i>Dr.</i>			
	To 3 boxes candles, 153 lb. at ,15	- -		22	95
	31st.				
7	<i>Nicholas Burkitt,</i>	<i>Cr.</i>			
	By 3 firkins butter, neat 125 lb. at ,25	-		31	25
6	<i>Willoughby Kingston,</i>	<i>Cr.</i>			
	By 11 cords hickory wood, at 9 75	- -		107	25
10	<i>Barton Smith,</i>	<i>Cr.</i>			
	By cash in full, - - - - -			252	17½
8	<i>Daniel Whitney,</i>	<i>Cr.</i>			
	By cash in full - - - - -			195	36¼

ALPHABET.

A Andrews William 2	B Burkitt Nich. 7 Bird William 7	C Calhoun Peter Chemist Nathaniel
D Davis William 1	E Eastborn Judith 10	F Farrand Samuel
G	H Hilyard Reuben 3	I—J Jones Duncan Joseph Samuel
K Kingston Willoughby 6	L	M M'Corkle James Mercer Shadrach
N Nathans Uriah 9	O Old Richard 10	P Pficheit Richard 8
Q Quinn Martin 6	R Russel Jane 8	S Smith Barton 2 Steinmetz Daniel 2 Stevens Samuel 2
T Tropic Hezekiah 5 Teacher John 7	U	V
W Whitney Danl. 4—8 Wetherill John 6 Wholesale Abijah 9	X	Y—Z Young & Davis 2

1818.	William Davis, Dr.	Dr.	D.	C.	1818.	Contra, Cr.	Dr.	D.	C.
Jan'y. 1	To sundries,	-	1	35 99		By account transferred to folio 1, Ledger B,		35 99	
1818.	James McCorkle, Dr.	Dr.			1818.				
Jan'y. 1	To sundries,	-	1	66 00	Aug. 1	By cash rec'd. of his brother,	6	40 00	
Aug. 12	To do.	-	6	24 00		By account transferred to folio 1, Ledger B,		50 00	
				90 00				90 00	
1818.	Peter Calkoun, Dr.	Dr.			1818.				
Jan'y. 5	To sundries,	-	1	45 00	Jan'y. 26	By cash in full,	2	45 00	
May 3	To do.	-	4	18 00		By account transferred to folio 1, Ledger B,		18 00	

1818.	Young & Davis, Dr.	Dr.	1818.	Contra,	Cr.	Dr.	D.	C.
Jan'y. 5	To sundries,	-	July 31	By sundries,	-	6	55	50
1818.	Barton Smith, Dr.	Dr.	1818.	Contra,	Cr.			
Jan'y. 6	To sundries,	-		By account transferred to				
Nov. 15	To do.	-		folio 10,	-			226 02½
22	To do.	-			-			
Dec. 17	To 4 reams paper,	-			-			
						10	18	00
								226 02½
1818.	William Andrews, Dr.	Dr.	1818.	Contra,	Cr.			
Jan'y. 7	To sundries,	-	Feb. 23	By cash in full,	-	3	31	50

1818.	Shadrach Mercer, Dr.	Dr.	Dr.	D.	C.	1818.	Contra, Cr.	Dr.	D.	C.
Jan'y 9	To sundries,	-	1	13 56		June 12	By cash in full,	-	5	71 56
June 6	To do.	-	5	58 00		Nov. 7	By malt, 120 bushels,	-	8	53 20
	To account transferred to Ledger B, folio 3,	-		71 56						126 76
				55 20						
				126 76						
1818.	Reuben Hilyard, Dr.	Dr.				1818.	Contra, Cr.			
Jan'y. 19	To sundries,	-	2	4 87½		May 29	By cash in full,	-	4	15 02½
April 5	To do.	-	3	10 15						
				15 02½						
1818.	Duncan Jones, Dr.	Dr.				1818.	Contra, Cr.			
Jan'y. 29	To sundries,	-	2	10 00		Oct. 15	By cash in full,	-	8	21 17½
Feb. 19	To do.	-	2	11 17½						
				21 17½						

Ledger.

1818.	<i>Daniel Whitney,</i>	<i>Dr.</i>	Dr.	1818.	<i>Contra,</i>	<i>Cr.</i>	Dr.	C.
Jan'y. 31	To sundries,	-	-	July 8	By sundries,	-	5	79 18
April 16	To do.	-	-		By acc't transferred to folio 8,	-		79 32½
June 12	To do.	-	-					158 50½
Sept. 15	To muslin, 1 piece,	-	-					
1818.	<i>Samuel Farrand,</i>	<i>Dr.</i>	Dr.	1818.	<i>Contra,</i>	<i>Cr.</i>		
Jan'y. 31	To sundries,	-	-	Aug. 6	By Russia sheeting, 4 pieces,	-	6	66 00
	To acc't transferred to Ledger	-	-					
	B, folio 3,	-	-					
1818.	<i>Daniel Steinmetz,</i>	<i>Dr.</i>	Dr.	1818.	<i>Contra,</i>	<i>Cr.</i>		
July 21	To sundries,	-	-	Feb. 1	By sundries,	-	2	17 65
Aug. 23	To 1 bbl. mackerel,	-	-		By account transferred to	-		13 76½
					Ledger B, folio 1,	-		31 41½

1818.	<i>Hezekiah Tropic,</i>	<i>Dr.</i>	Dr.	D.	C.	1818.	<i>Contra,</i>	<i>Cr.</i>	Dr.	D.	C.
Sept. 10	To cash in full, -	-	7	30 00		Feb. 11	By 1 box of oranges,		2	30 00	
1818.	<i>Samuel Stevens,</i>	<i>Dr.</i>				1818.	<i>Contra,</i>	<i>Cr.</i>			
Feb. 14	To sundries, -	-	2	20 84		Sept. 1	By sundries, -	-	7	38 62½	
June 30	To do. -	-	5	19 91			By acc't transferred to Ledger			2 12½	
				40 75			B, folio 1, -	-		40 75	
1818.	<i>Samuel Joseph,</i>	<i>Dr.</i>				1818.	<i>Contra,</i>	<i>Cr.</i>			
March 5	To sundries, -	-	3	56 00		Sept. 7	By cash in part, -	-	7	19 91	
July 25	To do. -	-	6	22 40			By acc't transferred to Ledger			58 49	
				78 40			B, folio 1, -	-		78 40	

1818.	Dr.	D.	C.	1818.	Contra,	Cr.	Dr.	D.	C.
March 16	Willoughby Kingston, Dr. To sundries, - - To acc't transferred to Ledger B, folio 3, - -	3	89 42	Dec. 31	By 11 cords wood,	-	10	107 25	
			17 83						
			107 25						
March 23	John Wetherill, Dr. To lead, - - -	3	291 00	July 17	By his note at 60 days for By acc't transferred to Ledger B, folio 1, - -		6	175 00	
								116 00	
								291 00	
March 30	Martin Quim, Dr. To sundries, - - -	3	56 87 1/2	Aug. 29	By 1 mahogany bedstead, By acc't transferred to Ledger B, folio 2, - -		7	38 00	
								18 87 1/2	
								56 87 1/2	

1818.	Nicholas Burkitt, Dr.	Dr.	D.	C.	1818.	Contra,	Cr.	Dr.	D.	C.
April 27	To sundries, -	-	3	4 00	Sept. 15	By cash in part, -	-	7	50 00	
May 18	To do. -	-	4	76 90	Dec. 31	By 3 firkins butter,	-	10	31 25	
	To account transferred to Ledger B, folio 3, -	-		80 90					81 25	
				35						
				81 25						
1818.	William Bird, Dr.	Dr.			1818.	Contra,	Cr.			
May 7	To sundries, -	-	4	22 00		By account transferred to Ledger B, folio 2, -	-		35 75	
July 27	To do. -	-	6	13 75						
				35 75						
1818.	John Teacher, Dr.	Dr.			1818.	Contra,	Cr.			
May 12	To sundries, -	-	4	48 75						
Aug 8	To 6 doz. writing pieces,	-	6	30 00	Aug. 8	By his bill for tuition, -	-	6	37 60	
	To account transferred to Ledger B, folio 3, -	-		78 75	Oct. 12	By his note at 60 days for	-	8	50 00	
				8 85					87 60	
				87 60						

Ledger.

1818.	<i>Jane Russel,</i>	<i>Dr.</i>	Dr.	D.	C.	1818	<i>Contra,</i>	<i>Cr.</i>	Dr.	D.	C.
June 3	To sundries,	-	4	14	55	Oct. 7	By cash in part,	-	8	50	00
Sept. 29	To do.	-	8	341	00		By acc't transferred to Ledger B, folio 2,	-		305	55
				355	55					355	55
1818.	<i>Richard Prichett,</i>	<i>Dr.</i>				1818.	<i>Contra,</i>	<i>Cr.</i>			
June 4	To sundries,	-	4	10	75		By acc't transferred to Ledger B, folio 2,	-		125	75
July 10	To do.	-	5	115	00						
				125	75						
1818.	<i>Daniel Whitney,</i>	<i>Dr.</i>				1818.	<i>Contra,</i>	<i>Cr.</i>			
Sept. 23	To acc't from folio 4,	-	79	32	1/2	Dec. 31	By cash in full,	-	10	195	36 1/2
Dec. 8	To sundries,	-	7	8	52						
	To sugar 3 bbls.	-	9	107	52						
				195	36 1/2						

1818.	<i>Abijah Wholesale, Dr.</i>	Dr.	D.	C.	1818.	<i>Contra,</i>	<i>Cr.</i>	Dr.	D.	C.
June 22	To note 60 days for	5	378 00		June 22	By 3 Hds. wine,	-	5	378 00	
	To acc't transferred to folio 3, Ledger B,		23 00		Sept. 5	By sundries,	-	7	23 00	
			401 00						401 00	
1818.	<i>Nathaniel Chemist, Dr.</i>				1818.	<i>Contra,</i>	<i>Cr.</i>			
Aug. 18	To sundries,	7	237 ½			By acc't transferred to folio 2, Ledger B,	-		18 37 ½	
Sept. 23	To do.	8	16 00				-			
			18 37 ½							
1818.	<i>Uriah Nathans, Dr.</i>				1818.	<i>Contra,</i>	<i>Cr.</i>			
Oct. 30	To sundries,	8	15 75			By acc't transferred to folio 2, Ledger B,	-		38 70	
Dec. 25	To 3 boxes candles,	10	22 95				-			
			38 70							

1818.	<i>Richard Old,</i>	<i>Dr.</i>	Dr.	D.	C.	1818.	<i>Contra,</i>	<i>Cr.</i>	Dr.	D.	C.
Nov. 10	To sundries,	-	8	12 08			By account transferred to Ledger B, folio 3,	-		12 08	
1818.	<i>Judith Eastborn,</i>	<i>Dr.</i>				1818.	<i>Contra,</i>	<i>Cr.</i>			
Dec. 1	To sundries,	-	9	25 83		Dec. 20	By cash in full,	-	10	25 83	
1818.	<i>Barton Smith,</i>	<i>Dr.</i>				1818.	<i>Contra,</i>	<i>Cr.</i>			
Dec. 17	To account transferred from folio 2,	-	226	02 $\frac{1}{2}$		Dec. 31	By cash in full,	-	10	252	17 $\frac{1}{2}$
	To sundries,	-	10	26 15							
				252	17 $\frac{1}{2}$						

Balance of Accounts in Ledger A.

[illegible]

ALPHABET TO LEDGER B.

A 	B Bird William 2 Burkitt Nich. 3	C Calhoun Peter Chemist Nathaniel
D Davis William 1	E 	F Farrand Samuel
G 	H 	I—J Joseph Samuel
K Kingston Willough- by 3	L 	M McCorkle James Mercer Shadrach
N Nathans Uriah 2	O Old Richard 3	P Prichett Richard
Q Quinn Martin 2	R Russel Jane 2	S Steinmetz Daniel Stevens Samuel
T Teacher John 3	U 	V
W Wetherill John 1 Wholesale Abijah 3	X 	Y—Z

Ledger B.

1818.	<i>William Davis,</i> Dr. To account transferred from Ledger A, folio 1, -	Dr.	35 99	1818.	Contra,	Cr.	Dr.	D.	C.
1818.	<i>James M^r Corlde,</i> Dr. To account transferred from Ledger A, folio 1, -	Dr.	50 00	1818.	Contra,	Cr.			
1818.	<i>Peter Calhoun,</i> Dr. To account transferred from Ledger A, folio 1, -	Dr.	18 00	1818.	Contra,	Cr.			
1818.	<i>Daniel Steinmetz,</i> Dr. To account transferred from Ledger A, folio 4, -	Dr.	13 76½	1818.	Contra,	Cr.			
1818.	<i>Samuel Stevens,</i> Dr. To account transferred from Ledger A, folio 5, -	Dr.	2 12½	1818.	Contra,	Cr.			
1818.	<i>Samuel Joseph,</i> Dr. To acc't from Ledger A, fol. 5,	Dr.	58 49	1818.	Contra,	Cr.			
1818.	<i>John Wetherill,</i> Dr. To acc't from Ledger A, fol. 6,	Dr.	116 00	1818.	Contra,	Cr.			

1818.	<i>Martin Quinn,</i> Dr. To account transferred from Ledger A, folio 6, -	Dr.	D.	C.	1818.	<i>Contra,</i>	Cr.	Dr.	D.	C.
			13	87½						
1818.	<i>William Bird,</i> Dr. To account transferred from Ledger A, folio 7, -		35	75	1818.	<i>Contra,</i>	Cr.			
1818.	<i>Jane Russel,</i> Dr. To account transferred from Ledger A, folio 8, -		305	55	1818.	<i>Contra,</i>	Cr.			
1818.	<i>Richard Prickett,</i> Dr. To account transferred from Ledger A, folio 8, -		125	75		<i>Contra,</i>	Cr.			
1818.	<i>Nathaniel Chemist,</i> Dr. To account transferred from Ledger A, folio 9, -		18	37½		<i>Contra,</i>	Cr.			
1818.	<i>Uriah Nathans,</i> Dr. To account transferred from Ledger A, folio 9, -		38	70	1818.	<i>Contra,</i>	Cr.			

1818.	<i>Richard Old,</i> Dr. To account transferred from Ledger A, folio 10, -	Dr.	12 08	1818.	<i>Contra,</i> Cr. By account transferred from Ledger A, folio 3, -	Dr.	55 20
1818.	<i>Shadrach Mercer,</i> Dr.			1818.	<i>Contra,</i> Cr. By acc't transferred from Ledger A, folio 4, -		45 87½
1818.	<i>Samuel Farrand,</i> Dr.			1818.	<i>Contra,</i> Cr. By account transferred from Ledger A, folio 6, -		17 83
1818.	<i>Willoughby Kingston,</i> Dr.			1818.	<i>Contra,</i> Cr. By account transferred from Ledger A, folio 7, -		95
1818.	<i>Nicholas Burkitt,</i> Dr.			1818.	<i>Contra,</i> Cr. By acc't from Ledger A, fol. 7,		8 85
1818.	<i>John Teacher,</i> Dr.			1818.	<i>Contra,</i> Cr. By acc't from Ledger A, fol. 9,		23 00
1818.	<i>Abijah Wholesales,</i> Dr.			1818.			

THE END.

